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ABSTRACT

The report describes the organizational phase of a project designed to create program models and supporting literature for exploratory industrial career development programs for grades seven to ten. The project was undertaken by Oregon State University in cooperation with the Oregon State Department of Education and involved the formation of a consortium for program development among four Oregon school districts. The successful completion of phase one (staff development, curriculum development, and administrative requirements development) resulted in the development of five program models, the participation of selected staff from each district in monthly inservice activities, the impact of the program on all industrial education staff, and the commitment by each school district of staff and/or funds toward the implementation of program models. Appendixes make up virtually all of the document and present detailed outlines of program goals and performance indicators for the four districts: the Albany Career Exploration/Industrial Arts (Student Managed Learning) Program; the Ashland Junior High School Exploratory Industrial Career Program; for Klamath Falls, two articulated programs (the Ponderosa Junior High School Industrial Career Exploration Program, and the Mazama Mid-High School Exploratory Industrial Career Program); and the Philomath Alive Program (Allied Learning in Vocational Exploration). (JR)

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INTERIM REPORT

CONSORTIUM FOR PLANNING, DEVELOPING, AND IMPLEMENTING EXPLORATORY INDUSTRIAL CAREER DEVELOPMENT MODELS

(PHASE I OF THREE PHASES)

Project # RE-3-74

Larry J. Kenneke, Project Director

Retrieval - Dissemination Center
Oregon Board of Education
942 Lancaster Drive N.E.
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OREGON STATE UNIVERSITY
CORVALLIS, OREGON

June 30, 1974

STATE DEPARTMENT OF EDUCATION
COMMUNITY COLLEGES AND CAREER EDUCATION

APPLIED RESEARCH

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STATE DEPARTMENT OF EDUCATION
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APPLIED RESEARCH

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ABSTRACT

TITLE: Consortium for Planning, Developing, and Implementing Exploratory Industrial Career Development Models (Phase I of Three Phases)

INSTITUTION: Oregon State University

PROJECT DIRECTOR: Larry J. Kenneke, Assistant Professor
Address: Industrial Education
Oregon State University
Corvallis, Oregon 97331
Telephone: (503) 754-2733

COSTS:

Federal	OSU	Local	Total
$12,498	$2,310	$6,125	$20,933

NUMBER OF STUDENTS AFFECTED: NA NUMBER OF STAFF INVOLVED: 25

PROJECT DESCRIPTION:

Oregon State University, in cooperation with the Oregon State Department of Education and four public school districts, has participated in a joint project designed to facilitate career development through exploratory industrial arts programs. Participating districts include Albany, Ashland, Klamath Falls, and Philomath.

Purpose

The plan calls for a three-year consortium of public school districts whose purpose is to design several alternate program models with accompanying materials which provide guidelines and give impetus to career development programs for industrial arts students in the middle grades.

Procedures and Outcomes

Phase I will facilitate conceptualization of alternate industrial career development models with accompanying materials. Phase II activities will result in further development and selected pretesting of Phase I instructional materials and inservice training of affected personnel. Phase III will encompass year-long staff development and pilot testing of Phase I and II career development materials. Models and accompanying materials will then be evaluated, revised, and disseminated to other districts.

Outcomes of Phase I in four schools: 1) Five program models were developed; one each for Albany, Ashland, and Philomath and two for Klamath Falls. 2) Selected staff from each district participated in monthly inservice activities. 3) All industrial education staff have been affected by the project. 4) Each district has committed staff and/or funds toward implementation of program models.

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A. BACKGROUND

Project Goals

The goal of the proposed study was to design several alternate program models and supporting literature which would provide guidelines and give impetus to exploratory industrial career development programs for middle grade students (grades seven through ten). The operational task became one of designing behavioral descriptions which would encompass the "developmental tasks" of career development, placing them at appropriate developmental levels, and designing learning experiences to enable each individual to successfully cope with the requisites of each vocational developmental task. Appropriate instructional components and curriculum materials were developed to enable each student, as he moves through school, to learn about the productive arena at higher levels of specificity.

Short Range Goals (Phase I)

Primary Goal. To provide classroom teachers with alternate exploratory industrial career development models and appropriate accompanying materials which provide guidelines and give impetus to career development programs for industrial arts students in the middle grades. (Middle school years were defined to range from grades seven through ten.)

Facilitating Objectives (Phase I)

1. To form a consortium for planning, developing, and implementing alternate exploratory industrial career development models.
2. Form an executive steering committee composed of consortium district superintendents or their appointed representatives, state employment service personnel, and representatives of industry to provide coordination and direction of project effort.
3. To initiate and conduct systematic staff development activities for purposes of model and material development.
4. To provide for external evaluation of the compatibility of models with current career development theory and practice.

5. Prepare and distribute a report of the models and materials developed in Phase I.

Number of Students Affected or Involved (Phase I)

NA.

Other Personnel Involved

1. All industrial education staff in participating schools.
2. Selected administrative staff in participating schools.
3. State Department of Education industrial education specialists.
4. Representatives of business and industry.
5. Representatives of disadvantaged and handicapped.
6. Selected industrial arts teachers and supervisors from throughout the state.
7. Selected laymen.
8. Members of the industrial education staff at Oregon State University.
9. Intermediate Education District coordinators.
10. Representatives of state employment service.

B. MAJOR OUTCOMES

Component I, Staff Development

1. To develop and initiate systematic staff development programs for purposes of model and material development.

   a. Consortium participants were oriented to purpose, scope, and sequence of project through an organizational meeting held in Klamath Falls on August 28, 1973.

   b. Five one-day workshops were devoted to identification of possible approaches to structuring alternate industrial career development models.

   c. Monthly consortium staff meetings were held to assist individual districts with their model development.

   d. One full-day evaluation session of each career development model was successfully completed.

Component II, Curriculum Development

1. To provide classroom teachers with alternate exploratory industrial career development models and appropriate accompanying materials which provide guidelines and give impetus to career development programs for industrial arts students in the middle grades.

   a. Career development tasks characteristic of each grade level which are central to the educational roles performed by industrial arts programs in the middle grades were identified.

   b. Behaviors characteristic of each vocational career developmental task within the exploratory program were identified.

   c. Educational experiences leading to specified goals and desired behavioral outcomes were identified and specified.

   d. Provisions for exceptional youth were made.

   e. Albany developed a model, based upon the student-managed learning concept and approximately 62 district-determined career activities.

   f. Ashland prepared an eight-area exploratory career cruise model. Herein students are afforded the opportunity to test personal interests and aptitudes against representative work tasks found in the eight industrial career areas.

g. Klamath Falls developed two articulated models. The seventh and eighth grade model reflects the career development tasks of the Industrial Arts Curriculum Project. The ninth and tenth grade model reflects the organizational structure of the four function-based technological areas. Herein students test their personal interests, abilities, and temperaments against representative work tasks performed in the areas of power, electricity/electronics, graphics, and materials-processes.

h. Philomath developed a multidisciplinary, student-managed exploratory career model. Students will be afforded the opportunity to test personal strengths and weaknesses against work activities in the areas of industrial arts, home economics, and art. The program goals, competencies, and performance indicators of the industrial arts area were dealt with in this project.

Component III, Administrative Requirements

1. To form a consortium for planning, developing, and implementing alternate exploratory industrial career development models.

   a. A three-year (three-phase) consortium of school districts was formed, whose purpose it was to schematize several alternate conceptual models with accompanying materials which provide guidelines and give impetus to career development programs for industrial arts students.

2. To form an executive steering committee composed of consortium school district superintendents or their appointed representatives, Oregon State Employment Service personnel, and a member of industry to provide coordination and direction of project effort.

   a. The executive steering committee met periodically to monitor project effort.

   b. The steering committee heard a presentation of Salem's difficulties in meeting project timelines. The committee accepted Salem's request to withdraw from the project (see attached letter).

3. To provide for external evaluation of the compatibility of models with current career development theory and practice.

   a. Each exploratory industrial career development model was submitted to a written evaluation of its compatibility with current career development theory and practice.

   b. External monitors prepared the written evaluations.

4. Prepare and distribute a report of the models and materials developed in Phase I.

   a. A written report was prepared, which describes each consortium participant's career development model and accompanying materials (see appendix).

   b. Copies of the final report have been distributed to consortium participants, Oregon State Department of Education personnel, and interested parties in Oregon and elsewhere.

C. FINAL EVALUATION

June 21, 1974

Dr. Larry J. Kenneke,
Department of Industrial Education,
Oregon State University,
Corvallis, Oregon 97331

RECEIVED JUN 2 5 1974

Dear Dr. Kenneke:

Materials you have provided relative to the Exploratory Industrial Career Development Model Consortium have been reviewed, and in the following paragraphs, related to the Phase I objectives and time line.

Component I- Staff Development-

Objectives in this area have been met very well by orientation, visitation, and workshop activities. Of special note is the excellent communications provided to participants and related personnel in this project. Results indicate that activities have been well planned and carried out.

Component II- Curriculum Development-

Four of the original five participating schools are on or ahead of schedule in development of curriculum. Vocational Development Tasks for junior high years were developed as a guideline for the development of learner tasks . Four schools have determined alternate program models and have spelled out goals and indicators for these models.

At this point it may be well for each participating school to take their goals and objectives and relate these back to the Vocational Development Tasks to assure that the models being developed have learnihg tasks outlined which will accomplish the seven development tasks for junior high years.

Component III- Administrative requirements-

The project director, steering committee, consortium participants, consultants, and evaluation members have been accomplishing their respective project responsibilities. The project has been well administered and directed through phaseI.

Working with this project has been rewarding and worthwhile. I am looking forward to PhaseII. As you meet and work this summer and next fall I would be happy to join with you as needed or requested to share ideas and to get a comprehensive view of this project.

Sincerely,
Gene Kelly
Gene Kelly,
Career Education Director,
Cascade U.H.# 5

D. SUMMARY

A consortium of four public school districts was formed to facilitate career development through exploratory industrial arts programs. Five written program models emerged. Klamath Falls developed two articulated models, one for the seventh and eighth grade junior high school and one for the ninth and tenth grade mid-high school. All models were complete with goal statements, competencies/course goals, and performance indicators.

Selected staff from each district participated in monthly inservice activities. The activities facilitated decision-making processes regarding how to best develop program models. Models were critiqued by participants, steering committee members, and external monitors. Revisions were made based upon feedback received. Participating districts have committeed staff and/or funds toward implementation of program models during the next school year.

E. CONCLUSIONS

The following conclusions were drawn, based upon the accomplishments and outcomes of Phase I project activity.

1. Alternate industrial career development models can be successfully developed through a consortium effort.
2. Career development tasks which are characteristic of the "middle" years (grades seven through ten) can be identified for purposes of program development.
3. Behaviors characteristic of each career development task can be identified for purposes of program development.
4. Educational experiences which lead to specified goals and competencies can be identified for purposes of program development.
5. Provisions for exceptional youth can be made for purposes of program development.

F. RECOMMENDATIONS

1. Recommendations for development and implementation.
    a. Select and/or develop instructional materials under the guidance and direction of competent professional and technical instructional material specialists.
    b. Provide for continuous external monitoring of developmental effort to ensure that materials reflect unique and specific characteristics of local districts as well as stated goals, competencies, and performance indicators.
    c. Conduct periodic joint work sessions to share ideas and materials.
    d. Form local career exploration advisory committees to give guidance and direction to the development and implementation of program materials.
    e. Conduct systematic staff development sessions to acquaint staff with the purpose, nature, and application of program materials.
    f. Pilot test selected materials in a random manner, analyze results, and revise accordingly.
2. Recommendations for further research.
    a. Form a consortium of school districts whose purpose is to develop alternate multidisciplinary exploratory career development program models.
    b. Form a center for exploratory career development programs where models, materials, and consulting services are available to participating districts.
    c. Develop a computerized and/or ready-access data bank of exploratory career development program goals, competencies, and performance indicators.
    d. Form a consortium of states whose purpose is to identify and/or develop alternate exploratory career development program models.
    e. Identify and/or develop evaluative criteria for application to exploratory industrial career development programs.

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APPENDICES

APPENDIX A

MINUTES
Exploratory Industrial Careers Project

Saturday, March 9, 1974, at Oregon State University

9:00 a.m.

The project director gave an overview of the project's purpose and progress to the morning session of the Oregon Industrial Education Association Spring Conference.

11:00 a.m.

The executive steering committee for the project met for a one-hour business session. Those in attendance included: James Grossnicklaus, Tom Hornig, Mike Wilson, Keith Bayne, Leon Olson, Wayne Kreger, John Fessant, and Larry Kenneke.

Each participating district reported on their progress in program development. Materials representing each district's progress were distributed and discussed.

Discussion centered about Salem's difficulty in meeting project goals and timelines. Tom Hornig presented the constraints under which program outlines must be developed within the district. In view of these restraints, the steering committee agreed with Mr. Hornig that Salem should consider withdrawing from the project. Mr. Hornig indicated that he would submit a letter of withdrawal to the project director immediately.

The agenda for the Friday, March 29, group meeting in Philomath was distributed and discussed. The meeting was adjourned at 11:45 a.m.

2:30 p.m.

Selected members from each participating district presented progress reports to the afternoon conference session. Gene Freeman presented the career development materials produced by the Albany district. Mike Wilson, of Ashland, presented his eight-area industrial career cruise program. Klamath Falls program outlines were presented by Bob Welzbacker and Keith Bayne. Wayne Kreger discussed the Philomath Mid-School multi-disciplinary program. Salem's progress was presented by Tom Hornig.

This session was one of the best-attended during the entire day. There is a great deal of interest in the efforts of the participating districts throughout the state.

APPENDIX B

SALEM PUBLIC SCHOOLS
1309 Ferry Street, S. E. Salem, Oregon 97308

WILLIAM M. KENDRICK, SUPERINTENDENT

Gary A. Knox, Supervisor
Program Planning and Development
2825 Commercial St., S.E.
Salem, Oregon 97302
(503) - 399-3082

April 10, 1974

Dr. Larry Kenneke, Project Director
Exploratory Industrial Careers Project
Industrial Education Department
Oregon State University
Corvallis, OR 97331

Dear Larry:

This letter is to confirm my conversation with you and other members of the steering committee March 9 in Corvallis.

You may recall that when you first talked with me about the possibility of Salem joining in the consortium to develop alternative programs for junior high school industrial arts I indicated that we were in the process of reorganization and that I did not know how this might affect our participation.

Upon adoption of the Comprehensive Educational Plan by our Board of Directors last fall and the subsequent explanation of its implication I became aware of our potential difficulty in meeting the time line set forth in the project. By comparison, you plan to accomplish in two years what we forsee as about a four or five year job in a district our size.

In all fairness to the project and to any other school which you may wish to include I do not feel that Salem should attempt to remain in the project any longer.

I have talked with Mr. McCanse and he shares my regret of our need to withdraw from the project, but he too was caught between the project's expectations and those of the Salem School District.

We welcome your keeping us abreast of the project's progress.

Very truly yours,

Thomas B. Hornig, Specialist
Career Education

TBH:bl

cc: Dr. Hampton
Gary Knox

ALBANY CAREER EXPLORATION/INDUSTRIAL ARTS PROGRAM
(STUDENT MANAGED LEARNING)

(For Discussion Only)

DEVELOPED BY

Eugene Freeman, Instructor
Lee Blattner, Consultant
James Grossnicklaus, Director of Career Education
John Fessant, State Specialist for Industrial Arts
Larry Kenneke, Project Director

PROJECT #RE-3-74

RESEARCH AND EXEMPLARY FUNDING

OREGON STATE DEPARTMENT OF EDUCATION

1973-74

ALBANY CAREER EXPLORATION/INDUSTRIAL ARTS PROGRAM
(STUDENT MANAGED LEARNING)
(For Discussion Only)

Tentative Program Goals

Students will:

Goal No.

1. Manage their own shop activities.
2. Select an instructional device and/or develop his own procedure for each project.
3. Record activities and evaluate their own performance for projects.
4. Work in at least 75 per cent of available areas (i.e., metals, woods, plastics, etc.) during the course of the year.*
5. Recognize the necessity of planning their activities.
6. Demonstrate a positive attitude toward planning their activities.
7. Demonstrate positive attitudes toward self-instruction.
8. Demonstrate less dependence on the instructor.
9. Identify a wide range of occupational possibilities.
10. Demonstrate awareness of personal strengths and weaknesses as they relate to his/her occupational possibilities.
11. Demonstrate skills and knowledge necessary to explore the job market as it relates to the individual worker.
12. Demonstrate skills and knowledge necessary to locate and interpret occupational information.
13. Prepare a career plan and personal data sheet correlating personal interests and abilities with this plan.
14. Demonstrate proper job application skills and knowledge.
15. Demonstrate the ability to get along with others on the job.
16. Demonstrate understanding of the fundamental relationships between productivity and occupational success in the world of work.

---

*Implementation of Albany Career Exploration/Industrial Arts (Student Managed Learning) program need not be confined to the technical content areas listed herein. Technical content areas should be selected to fit the student and facility needs of the implementing school.

ALBANY CAREER EXPLORATION/INDUSTRIAL ARTS PROGRAM
(STUDENT MANAGED LEARNING)

Sample Performance Indicators

(For Discussion Only)

Goal Reference Number

1.1. Given appropriate forms, record daily attendance.

1.2. Given appropriate forms, compute and record material and supply purchases.

1.3. Given appropriate guidelines, evaluate safety practices and cleanliness performance.

2.1. Given appropriate instructional devices, select those which best enable mastery of selected skills and knowledges.

2.2. List the steps necessary for completing a selected process.

2.3. Given appropriate tools and equipment, demonstrate their safe use.

2.4. Given appropriate tools and equipment, demonstrate their proper use.

2.5. Develop a project plan* containing a listing of procedures.

2.6. Complete a selected project according to plan.

3.1. Given a student performance form, record activities completed.

3.2. Given evaluative criteria, complete a self-evaluation of selected projects.

4.1. Given a sufficient number of areas, perform selected activities in at least 75 per cent of available areas during the course of the year.

4.2. Perform basic metalworking operations.

    4.2.1. Demonstrate understanding of and the ability to complete hot metal working operations.

        4.2.1.1. Demonstrate the correct procedures when working with:

            Arc welding
            Brazing
            Cutting
            Gas welding
            Soldering
            Spot welding.

---

*Selected by the student to meet personal needs and interests.

4.2.1.2. Demonstrate proper foundry procedures for:

- Pouring
- Pattern making
- Molding
- Core making
- Styrofoam casting
- Investment casting.

4.2.1.3. Demonstrate proper procedures when working with the:

- Foundry furnace
- Forge
- Soldering furnace.

4.2.2. Demonstrate understanding of and the ability to perform cold metal working processes.

4.2.2.1. Demonstrate correct procedures when performing basic sheet metal processes:

- Forming
- Bending
- Cutting
- Etching
- Pattern Layout
- Riveting
- Peening
- Rolling
- Seaming
- Soldering
- Spinning.

4.2.2.2. Demonstrate the correct procedures when performing the processes of:

- Cold bending
- Cutting
- Drilling
- Filing
- Hot bending
- Riveting
- Tap and die threading
- Twisting.

4.2.2.3. Demonstrate correct procedures when operating cold metal stationary equipment:

- Bender
- Drill press
- Forming roller
- Grinder
- Metal lathe
- Pan brake
- Power hack saw
- Shear
- Wire wheel
- Milling machine
- Combination rotary machine.
- Sander/grinder.

4.2.2.4. Given appropriate instruction and resources, finish projects using appropriate procedures.

4.3. Demonstrate understanding of and ability to perform basic operations and processes common to the graphic communications field.

4.3.1. Demonstrate proper use and care of basic tools, instruments, and equipment.

4.3.2. Select an idea and design a trademark, family crest, etc. to represent it.

4.3.3. Analyze proof sheets of photos and crop to improve quality.

4.3.4. Develop designs and paste-ups.

4.3.5. Illustrate proper use of dimensions and tolerancing.

4.3.6. Communicate an idea by making a thumbnail, rough, and finished sketches.

4.3.7. Using symbols, prepare a working drawing which conforms to accepted drawing standards.

4.3.8. Demonstrate understanding of design methodology by applying basic principles to the solution of selected problems.

4.3.9. Demonstrate competence in photography by properly completing selected assignments.

4.3.10. Select and use a reproduction system that best meets the requirements of a given job.

4.3.11. Assemble visual materials, using at least two different reproduction methods.

4.3.12. Operate at least two different pieces of reproduction equipment in a safe and proper manner.

4.3.13. Operate a press in a safe and proper manner.

4.3.14. Apply sketching and mechanical aids to render technical illustrations.

4.3.15. Sketch and identify isometric, oblique, orthographic, and geometric constructions.

4.3.16. Demonstrate knowledge of the principles of orthographic projection, sketching, sectioning, and working drawings.

4.4. Demonstrate understanding of and perform basic operations and procedures common to the field of industrial mechanics.

4.4.1. Demonstrate the proper care and use of basic hand and power tools.

4.4.2. Identify each of the three types of levers.

4.4.3. Demonstrate how each of the three levers is used to gain mechanical advantage.

4.4.4. Identify the wheel, axle, pulley, inclined plane, screw, and the wedge as found in simple machines.

4.4.5. Demonstrate how mechanical advantage is gained in each type of simple machine.

4.4.6. Demonstrate an understanding of and the ability to apply these simple machines to the more complex machines of today.

4.4.7. Demonstrate the ability to perform basic service operations on both two- and four-stroke engines.

4.4.8. Demonstrate the ability to increase speed and decrease torque (or decrease speed and increase torque) by either changing the size of pulleys or chain sprockets.

4.4.9. Given four basic types of gears, identify the spur, helical, worm, and bevel.

4.4.10. Demonstrate the ability to increase speed and decrease power or decrease speed and increase power by changing the sizes of the gears on an input or output shaft.

4.4.11. Recognize the basic components of mechanical systems as they relate to this course.

4.4.12. Demonstrate the ability to connect basic components into a mechanical system.

4.4.13. Recognize the basic components of the hydraulic system.

4.4.14. Demonstrate the ability to connect basic components into a hydraulic system.

4.4.15. Recognize the basic components of a fluid power system.

4.4.16. Connect basic components into a given fluid power system.

4.4.17. Connect basic components into a fluid-mechanical system that will automatically control the motion in a system.

4.4.18. Assemble an electric motor driven system that can be shifted in and out of operation through the use of fluid controls.

4.4.19. Demonstrate the ability to perform basic maintenance procedures on selected machines.

4.5. Demonstrate the ability to perform basic operations common to the wood/forest products industry.

4.5.1. Demonstrate the ability to perform basic hand woodworking processes in a safe and proper manner.

4.5.1.1. Demonstrate correct hand sanding procedures.

4.5.1.2. Demonstrate proper use of hand scraping tools.

4.5.1.3. Demonstrate proper use of wood files.

4.5.1.4. Demonstrate correct hand plane procedures when surfacing woods.

4.5.1.5. Cut wood to specifications using hand saws.

4.5.1.6. Shape and remove material to specification using carving tools.

4.5.1.7. Drill holes to specification using hand drills.

4.5.1.8. Join materials together using proper joints and processes.

4.5.2. Demonstrate the ability to perform basic machine woodworking procedures in a safe and proper manner.

4.5.2.1. Cut material to specified size using the band saw.

4.5.2.2. Demonstrate ability to drill holes to specification using a power drill.

4.5.2.3. Demonstrate ability to drill holes to size using a drill press.

4.5.2.4. Cut material to dimension using the table, circular, radial arm, scroll, and saber saws.

4.5.2.5. Demonstrate the ability to operate the jointer.

4.5.2.6. Turn material to tolerences using the wood lathe.

4.5.2.7. Demonstrate the ability to remove material using the belt, disc, and vibrating sander.

4.5.2.8. Demonstrate the ability to remove material using the uniplane.

4.5.2.9. Remove material using the sander/grinder.

- 4.5.2.10. Apply appropriate finishes to selected projects.

4.6. Demonstrate the ability to perform basic operations and procedures common to the field of electricity-electronics.

- 4.6.1. Demonstrate understanding of the basic fundamentals of electricity.
    - 4.6.1.1. Demonstrate correct safety procedures.
    - 4.6.1.2. Distinguish between various wire gauges.
    - 4.6.1.3. Identify common electrical components.
    - 4.6.1.4. Compute resistance given current and voltage.
    - 4.6.1.5. Compute current, given resistance and voltage.
    - 4.6.1.6. Compute voltage, given resistance and current.
    - 4.6.1.7. Define voltage, current, and resistance and state their relationships.
    - 4.6.1.8. Describe the difference between an AC and DC voltage and state a source for each.
    - 4.6.1.9. Solve for voltage drops around a closed circuit with a given source voltage.
    - 4.6.1.10. Solve for power consumed in a series circuit.
    - 4.6.1.11. Identify and describe basic electrical symbols.
- 4.6.2. Demonstrate the ability to apply basic electrical fundamentals to practical problems.
    - 4.6.2.1. Demonstrate the ability to use basic electrical hand tools in a safe and effective manner.
    - 4.6.2.2. Given electrical components, solder them in an acceptable manner using a soldering gun.
    - 4.6.2.3. Given electrical schematics, construct basic circuits as directed.
    - 4.6.2.4. Connect a VTVM and/or VOM into a circuit and record the measurements.
    - 4.6.2.5. Given a power supply, apply varying outputs to selected laboratory problems.
    - 4.6.2.6. Given different transistors, determine the types with an ohmmeter.
    - 4.6.2.7. Given a schematic, assemble a forward biased transistor circuit.
    - 4.6.2.8. Given appropriate components, rectify an AC voltage.
    - 4.6.2.9. Given appropriate components, remove ripple from a rectified AC voltage.

- 4.7. Demonstrate the ability to perform basic plastics forming, assembly, and finishing operations.
  - 4.7.1. Demonstrate the ability to perform basic plastic processes.
    - 4.7.1.1. Perform injection molding operations.
    - 4.7.1.2. Perform blow molding operations.
    - 4.7.1.3. Perform expandable polystyrene operations.
    - 4.7.1.4. Perform compression molding operations.
    - 4.7.1.5. Perform vacuum forming operations.
    - 4.7.1.6. Perform plastisol molding operations.
    - 4.7.1.7. Perform powder molding operations.
    - 4.7.1.8. Perform foam molding operations.
    - 4.7.1.9. Demonstrate proper plastics casting procedures.
    - 4.7.1.10. Perform plastics cementing operations.
    - 4.7.1.11. Weld plastic materials together using proper operations.
    - 4.7.1.12. Cut and machine plastics materials to specifications.
    - 4.7.1.13. Demonstrate understanding of the metal coating process.
    - 4.7.1.14. Decorate plastics through the hot stamping process.
    - 4.7.1.15. Decorate plastics through the screen printing process.
    - 4.7.1.16. Perform engraving operations on plastic materials.
    - 4.7.1.17. Polish plastics materials to specifications.
    - 4.7.1.18. Laminate fiberglas to specifications.
    - 4.7.1.19. Layup laminated fiberglas to specifications.
  - 4.7.2. Demonstrate the ability to operate plastics equipment.
    - 4.7.2.1. Operate a heat gun safely and properly.
    - 4.7.2.2. Operate a chopper safely and efficiently.
    - 4.7.2.3. Operate a gel coat spray gun.
- 4.8. Demonstrate the ability to perform basic crafts operations and procedures.
  - 4.8.1. Demonstrate the ability to correctly perform basic processes when working with:
    - Leather stamping
    - Leather tooling
    - Copper enameling

Foil tooling

Wood carving

Dying

Rock cutting

Rock polishing

Rock grinding

Fly tying

Marquetry

Decopague.

4.9. Demonstrate an understanding of and the ability to apply basic general industrial practices and procedures.

- 4.9.1. Given appropriate resources, cast materials to specification.
- 4.9.2. Given tools and materials, cut and place tile as specified.
- 4.9.3. Given plans, cut rafters to specifications.
- 4.9.4. Given blueprints, frame a wall to specifications.
- 4.9.5. Given a problem, lay brick and stone to specifications.
- 4.9.6. Given instructions, mix concrete to specifications.
- 4.9.7. Given instructions, mix mortar as directed.
- 4.9.8. Given a problem, perform basic plumbing operations as directed.
- 4.9.9. Given instructions, apply roofing materials as directed.
- 4.9.10. Given plans, cut and set glass as directed.
- 4.9.11. Given plans, apply drywall in the prescribed manner.
- 4.9.12. Given a set of houseplans, assemble a model to scale.
- 4.9.13. Given a problem, engage in a mass production effort.
- 4.9.14. Given blueprints, construct a half scale corner construction.
- 4.9.15. Given blueprints, construct a full scale corner construction.
- 4.9.16. Given blueprints, construct a structure to specifications.

5.1. Given appropriate guidelines, develop a plan for their activities.

6.1. Given an "Attitude Toward Planning Instrument", exhibit a significant increase in positive attitude toward planning activities.

7.1. Given an "Attitude Toward Self-Instruction Instrument", exhibit a significantly more positive attitude toward self-instruction.

8.1. Given an "Instructor Dependence Assessment Instrument", exhibit a significant decrease in dependence on the instructor.

9.1. List five key jobs in the Oregon communications career cluster.

9.2. List five key jobs in the Oregon metals career cluster.

9.3. List five key jobs in the Oregon mechanics career cluster.

9.4. List five key jobs in the Oregon forest products career cluster.

9.5. List five key jobs in the Oregon electrical career cluster.

9.6. List five key jobs in the Oregon construction career cluster.

9.7. List five key jobs in the Oregon career cluster not already researched.

10.1. Describe your life goals. Describe the kind of job you would like to have, family life, hobbies, and other things.

10.2. Describe the kinds of things you like to do. Do you like to work with data, people, or things?

10.3. Describe those things you do real well.

10.4. Describe your feelings about school and work. How do you feel about getting to work or school on time, doing your best on the job, taking rest breaks, leaving school or work early, working with others, and attendance at school or work?

10.5. Describe how well you adapt to frequent changes, repetitive or cycle operations, close supervision, being responsible for the activities of others, working alone, working under stress, and working under precise, set limits and tolerances.

10.6. Describe courses you have had which have helped you learn about jobs and work.

10.7. Describe both part- and full-time work experiences you have had and tell how they have helped you learn about jobs and work.

10.8. List the jobs held by members of your family and describe what they do in these jobs.

11.1. List several jobs which require skills and knowledges similar to those learned in this class.

11.2. List several job openings in this town which require skills and knowledges similar to those learned in this class.

11.3. List several job openings in your school building or district requiring skills and knowledges similar to those learned in this class.

11.4. List and describe several state-wide job openings requiring skills and knowledges similar to those learned in this class.

11.5. List and describe several nation-wide job openings requiring skills and knowledges similar to those learned in this class.

11.6. List and describe several world-wide job openings which require skills and knowledges similar to those learned in this class.

11.7. Select a job and list its opportunities for advancement.

11.8. Describe the employment trends for a job which interests you.

12.1. Using the "Occupational Outlook Handbook" as a resource, list the special abilities and interests required of workers employed in a job of your choice.

12.2. Using the "Dictionary of Occupational Titles" (Volumes I and II) as a resource, write out the special career training requirements for a selected job.

12.3. Using the "Encyclopedia of Careers" as a resource, select a job and write a description of the conditions under which the work must be performed.

12.4. Using the "Handbook of Job Facts" as a resource, write out a list of on-the-job tasks performed by a selected worker.

12.5. Using employment service bulletins as a resource, list the starting salaries for workers in two selected occupations.

12.6. Go to your local employment office and get a list of job openings which require skills similar to those used in this class.

12.7. Interview a worker employed in a selected job and write out his job satisfactions and dissatisfactions.

12.8. Interview a selected employer and write out those things he expects from his workers.

13.1. Write out a tentative career plan which describes your plans for the future, how you propose to get there, available resources, and dates by which you hope to achieve these goals.

13.2. Write out a personal data sheet which includes information on personal items, education, work experience, hobbies, and club activities.

13.3. Select a job and describe the length of time it takes to learn how to perform the work.

13.4. Select a job which requires a period of apprenticeship and describe these requirements.

13.5. Write a description of the special career preparation required in order to get a job of your choice.

13.6. Write a description of the general educational background required of a person who is employed in a selected job.

13.7. List the name and addresses of several trade or technical schools which offer courses leading to jobs which are of interest to you.

13.8. List the names and addresses of several community colleges which offer courses preparing people for employment in jobs which interest you.

13.9. List the names and addresses of several branches of the armed services offering courses leading to jobs which interest you.

13.10. List the names and addresses of several colleges or universities offering courses leading to jobs which interest you.

13.11. List courses in your school district which will help you prepare for a job which interests you.

13.12. Select a job and describe the costs involved in getting the training required for employment.

13.13. Select a job and describe the entrance requirements to a training program that will develop job entry level skills.

14.1. Write a letter of application for a job which interests you.

14.2. Write a personal resume.

14.3. Secure and fill out an application blank for a job which interests you.

14.4. Engage in a simulated job interview with another student.

14.5. Secure and fill out a social security application form.

14.6. Secure and fill out an employee's withholding exemption form.

15.1. Ask a teacher or employer to rate you on the quality and quantity of work you produce. Report the rating in writing.

15.2. Describe, in writing, how you feel you should treat others and their personal property.

15.3. Describe in writing how you feel about: a) getting to school or work on time, (b) taking coke breaks, c) leaving school or work early, and d) not showing up for school or work.

15.4. Ask a teacher or employer to rate your attitude and cooperation toward school or work assignments. Report this rating in writing.

15.5. Ask your classmates or fellow-workers to tell you what kind of a team member you are when working on a group project. Report the results in writing.

15.6. Describe, in writing, what you feel you owe an employer, teacher, other students, or fellow-workers.

16.1. Explain, in writing, how supply and demand of available workers and products affects costs.

16.2. Describe, in writing, at least three things which influence the success or failure of a business.

16.3. Describe, in writing, how business and personal productivity are related.

16.4. Describe, in writing, the ways in which government influences private enterprise.

16.5. List at least three things to keep in mind when purchasing consumer goods so you will get the best quality for a reasonable price.

16.6. Describe five basic steps in the collective bargaining process.

EXPLORATORY INDUSTRIAL CAREER PROGRAM
for
ASHLAND JUNIOR HIGH SCHOOL
(for discussion only)

Developed by

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EXPLORATORY INDUSTRIAL CAREER PROGRAM
ASHLAND JUNIOR HIGH SCHOOL
(For Discussion Only)

Overall Program Goals*

1. Students will demonstrate habits necessary to function effectively in selected industrial career areas.

2. Students will recognize the importance of positive attitudes toward work.

3. Students will be able to maintain acceptable interpersonal working relationships.

4. Students will be able to make appropriate "tentative" career decisions.

5. Students will be able to demonstrate proper use of the tools, machines, and materials found in selected industrial career clusters.*

6. Students will be able to identify and describe a wide variety of job opportunities in industrial and related career clusters.**

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* Selected program goals may meet graduation requirements.

** Selected industrial areas to include:

I. Woods/Wood Products

II. Drafting

III. Graphic Arts

IV. Electricity/Electronics

V. Metals/Metal Products

VI. Power Mechanics

VII. Plastics/Plastics Products

VIII. Crafts

Woods/Wood Projects Course Goals

The student will be able to:

1. Identify and describe a variety of job opportunities in wood products and related fields.
2. Interpret plans and blueprints.
3. Select proper tools and materials.
4. Operate hand and power tools.
5. Demonstrate appropriate processing techniques.
6. Demonstrate techniques of finishing.
7. Demonstrate safe work habits.
8. Demonstrate desirable work behaviors.
9. Relate personal interests and abilities to work performed.
10. Make tentative career decisions.

Drafting Course Goals

The student will be able to:

1. Identify and describe a variety of job opportunities in drafting and related fields.
2. Demonstrate the ability to use basic drafting tools and materials.
3. Perform basic drafting procedures.
4. Demonstrate desirable work behavior.
5. Relate personal interests and abilities to work performed.
6. Make tentative career decisions.

Graphic Arts Course Goals

The student will be able to:

1. Identify and describe a variety of job opportunities in the graphic arts and related fields.
2. Perform basic graphic processes.
3. Operate basic graphic arts tools and equipment.

4. Demonstrate safe work habits.
5. Demonstrate acceptable work behaviors.
6. Relate personal interests and abilities to work performed.
7. Make tentative career decisions.

Electricity/Electronics

The student will be able to:

1. Identify and describe a variety of job opportunities in electrical and related fields.
2. Demonstrate safe electrical practices.
3. Demonstrate an understanding of electrical power generation.
4. Operate basic electrical instruments.
5. Use basic electrical tools and materials.
6. Connect basic electrical circuits.
7. Demonstrate acceptable work behaviors.
8. Relate personal interests and abilities to work performed.
9. Make tentative career decisions.

Metal Products

The student will be able to:

1. Identify and describe a variety of job opportunities in the metal working and related fields.
2. Interpret plans and blueprints.
3. Select proper tools and materials.
4. Operate hand and power tools.
5. Perform basic metalworking processes.
6. Demonstrate safe work habits.
7. Demonstrate acceptable work behavior.
8. Relate personal interests and abilities to work performed.
9. Make tentative career decisions.

Power Mechanics

The student will be able to:

1. Identify and describe a variety of job opportunities in mechanics and related fields.
2. Select proper tools and equipment.
3. Operate basic mechanics tools and equipment.
4. Perform basic operations on mechanical, electro-mechanical, fluid power, and mechanical transmission systems.
5. Demonstrate safe work habits.
6. Demonstrate desirable work behaviors.
7. Relate personal interests and abilities to work performed.
8. Make tentative career decisions.

Plastics Course Goals

The student will be able to:

1. Identify and describe fields of work.
2. Interpret plans and blueprints.
3. Select proper tools and materials.
4. Operate hand and power tools.
5. Perform basic processes.
6. Demonstrate safe work habits.
7. Demonstrate desirable work behaviors.
8. Relate personal interests and abilities to work performed.
9. Make tentative career decisions.

Crafts Course Goals

The student will be able to:

1. Identify and describe a variety of job opportunities utilizing skills and knowledges similar to those used in the crafts area.
2. Interpret plans and blueprints.

3. Select proper tools and materials.
4. Operate hand and power tools.
5. Perform basic craft processes.
6. Demonstrate safe work habits.
7. Demonstrate desirable work behaviors.
8. Relate personal interests and abilities to work performed.
9. Make tentative career decisions.

WOODS/WOOD PRODUCTS
PERFORMANCE INDICATORS
(For discussion only)

CAREERS (goals 1, 9, 10)

1. Given employment service job bulletins, list at least five jobs available in the wood products industry.

2. Given the Occupational Outlook Handbook, list the working conditions under which a selected wood products worker must perform his job.

3. Engage in a simulated job interview with another student.

4. Given employment service manpower data, describe the current supply and predicted need for workers in the wood products field.

5. Given a personal attitude assessment form, perform a self evaluation.

6. Locate the names and addresses of places where job entry level skills may be gained for employment in a selected wood products job.

LUMBER MANUFACTURE (goals 1, 2, 9)

1. Enumerate the unique characteristics of woods, as compared to metals and plastics.

2. Given random steps of lumber manufacture, from tree to standard materials, arrange them in proper sequential order.

3. Given two cross-sectional views of a tree trunk, show by drawing lines, plain sawed and quarter sawed lumber.

4. Analyze air drying and kiln drying; the reasons for drying, when each method is appropriate, the process used in air drying and kiln drying.

HARDBOARD, PARTICLE BOARD, & PLYWOOD (goals 1, 2, 3, 4, 5, 7, 8, 9)

1. Given sawdust, a steel compression mold, and a hydraulic press, produce a small sample of hardboard.

2. Given wood chips, a steel compression mold, and a hydraulic press, produce a small sample of particle board.

3. Given three plies of veneer, thermosetting adhesive caul plates, and a heated hydraulic press, the student will produce a four-inch square of plywood.

BASIC CALCULATIONS (goals 2, 3, 9)

1. Given the lumber size, calculate square feet and board feet for four varied situations.
2. Compute the cost of a complete project, hardware and finish material.

WOOD IDENTIFICATION (goals 3, 4, 7, 8)

1. Select the appropriate description of hardwoods from four possible alternatives.
2. Select the appropriate description of softwood from four possible alternatives.
3. When given samples of hardwoods and softwoods, identify each sample.

LAMINATION (goals, all)

1. Compare and contrast characteristics of laminated and solid wood products.
2. Indicate when cross-banding is more desirable than laminating and vise-versa.
3. Produce a laminated product comprised of two or more veneer layers.

MILLWORK (goals, all)

1. Demonstrate safe operating practices of tools and machines.
2. Match the description of operations to the corresponding machine names.
3. List procedure for squaring a board.
4. Match names of cuts and joints with their corresponding graphic representations.
5. Apply correct joint for given applications.
6. Do millwork required to manufacture wooden products.
7. Apply correct fastener for given applications.
8. Apply correct assembly methods for given applications.

PAPER PRODUCTS (goals, all)

1. From a list of descriptive phrases, select an appropriate description of paper.
2. Describe the Fourdrinier process of making paper.
3. Discuss why conservation of paper is necessary.
4. Given the necessary supplies, manufacture a 6" x 8" piece of writing paper.
5. Given a list of eight paper products distinguish fine papers from industrial papers.
6. Given the necessary materials construct a section of corrugated board.
7. Describe package testing procedures which were demonstrated.
8. Given a list of prices, figure and write out the cost for a particular size box within 10 cents of the exact cost.

FINISHING (goals, all)

1. Prepare wood surfaces for finishing by sanding.
2. Read coded information on the back of coated abrasives and distinguish between common types, noting relative merits.
3. Stain wood to desired shade.
4. Demonstrate use of wood filler.
5. Brush or spray successive coats of finish material.
6. Use rubbing compound to "rub out" a finish coat.
7. Produce a natural oil finish.
8. Produce a sable finish, using black lacquer and white lead.

DRAFTING
PERFORMANCE INDICATORS
(for discussion only)

CAREERS (goals 1, 5, 6)

1. Describe in writing, at least five jobs which require workers to process skills and knowledges similar to those learned in this class.

2. Using at least three different career resources describe the working conditions of three jobs in the drafting industry.

3. Describe, in writing, the special career preparation required for entry into a selected drafting job.

4. List the towns or cities in this state where there are job openings for people in the drafting field.

5. Secure and fill out a social security application blank.

6. List economic and fringe benefits to be gained from a selected job in the drafting.

TOOLS & MATERIALS (goals 2, 3, 4, 5)

1. Demonstrate the proper use of basic drafting instruments.

2. Given drawing assignments, select proper materials.

PROCEDURES (goals 2, 3, 4, 5)

1. Draw and identify isometric, oblique, perspective, orthographic projections, and geometric constructions.

2. Give three reasons for using standards to facilitate communications.

3. Describe the function of a standard symbol and illustrate its use.

4. Demonstrate knowledge of the principles of orthographic projection, sectioning, working, detail and assembly drawings.

5. Describe dimensions and tolerancing, and illustrate the use of each.

6. Given undimensioned drawings, dimension each drawing using standard practices.

7. Given a hypothetical situation, draw mechanically four types of pictorial drawings to solve the problem: oblique, isometric, one point perspective, and two point perspective.

8. Describe at least three usages for pictorial illustrations.

9. Given the required information, draw an exploded view of a drawing and render the parts.

RECORDING THE IDEA (goals 2, 3, 4, 5)

1. Demonstrate an idea or concept by making thumbnail, rough, and finished sketches.

2. Describe how one might use a sketch as an aid to communicating ideas.

DEVELOPING THE IDEA (goals)

1. Illustrate the function of a mock-up by definition and/or construction.

2. Given a hypothetical problem, choose and justify the need for a model or mock-up.

3. Name and describe two alternate ways (computerized and system similation) to accomplish the communication provided by the mock-ups.

4. Evaluate the communication provided by the mock-up.

IMAGING THE DEVELOPED IDEA (goals 2, 3, 4, 5)

1. Using symbology techniques, prepare a working drawing which conforms to accepted drawing standards.

2. Name, compare, and contrast the two kinds of working drawings (detail and assembly) utilized by industry.

3. Describe the functions of a computer as a means to make a working drawing.

4. Demonstrate their ability at making a working drawing utilizing photo-mechanical drawing techniques.

5. Demonstrate their ability at cutting and pasting working drawings following instructions prescribed at the start of the exercise.

6. Solve common construction problems, showing knowledge of basic materials and processes.

7. Recognize four types of engineering graphics studies and give a brief description and two advantages and disadvantages of each.

8. Describe what specifications are and how they aid communication in at least two ways.

9. Demonstrate understanding of the specification concept by writing specifications for one of their drawings.

GRAPHIC ARTS
PERFORMANCE INDICATORS
(FOR DISCUSSION ONLY)

The student will be able to:

CAREERS (goals 1, 6, 7)

1. List and describe at least five key occupations in the graphic arts industry.
2. Relate your personal interests and abilities to the work required of persons employed in selected graphic arts jobs.
3. List the name and location of at least five job openings for people with graphic arts background.
4. Using at least four different career resources, locate and describe the starting salaries for persons employed in selected graphic arts jobs.
5. Write out a personal career plan.
6. Complete a job application blank.

IDEAS, SYMBOLS, DESIGN (goals, all)

1. Observe the environment; react to and express what is seen.
2. Formulate individual ideals and set personal goals.
3. Discuss the importance of originality.
4. Discuss the different levels of creativity.
5. Discuss and use design elements (line, form, shape, value, color, texture) and design principles (balance, rhythm, dominance) in a collage.
6. Use standard symbols in an effective manner.
7. Develop a personal trademark which reflects beliefs and values.

COMPOSITION SYSTEMS (goals, all)

1. List the various composition systems and devices.
2. Demonstrate the ability to assemble an appropriate image carrier for the various printed media.

3. Compare and contrast cold composition and hot composition.

4. List the various methods of transferring the image by conventional printing methods.

5. Operate successfully all equipment necessary for reproduction of a given message.

6. Produce printed media materials that will present the idea in such a manner so as to communicate with the selected receiver.

REPRODUCTION (goals, all)

1. Identify the common methods of printing.

2. List the advantages and disadvantages of each reproduction system.

3. List the printed media used in visual communication.

4. Compare and contrast the various printing reproduction systems in terms of application.

5. Discuss the process of gravure printing, comparing it to the three major printing processes.

6. List the advantages and disadvantages of gravure printing.

7. List and describe the different types of duplicating processes.

8. List the advantages and disadvantages of each of the duplicating processes and state the primary area of application for each process.

9. Name and describe at least three reproduction processes used to make prints.

10. Given an original, make a blue line print and explain the process.

11. Given a 35 mm negative frame, mount it in an aperture card.

12. Given a hypothetical situation, select the most appropriate printing process and tell why it would best satisfy the situation.

PHOTOGRAPHIC COMMUNICATION (goals, all)

1. Demonstrate understanding of: f - stop, focal length, speed, and depth of field.

2. Demonstrate understanding of lighting and its effect on photographic film.

3. Demonstrate ability to use light meters properly.

4. Select proper film for given situations.

5. Process black and white film properly.

6. Develop black and white prints properly.

7. Demonstrate understanding of the principles of design and composition in photography.

8. Demonstrate ability to mount and retouch photographs properly.

STORAGE AND RETRIEVAL SYSTEMS (goals, all)

1. Name and describe at least three ways of storing and retrieving information.

2. Given a hypothetical situation, choose and defend their choice of the most appropriate storage and retrieval systems to solve the problem.

3. Develop criteria for a storage system of one type of their choosing.

DISSEMINATION (goals, all)

1. Demonstrate the concepts, processes, and techniques used to prepare materials for distribution after the reproduction process.

2. Each student will list the various distribution and bindery techniques.

3. List at least three of the communicative transmission systems in the wire and cable area.

4. Define and describe each of the three systems included in the transmission topic.

SYSTEMS APPROACH (goals, all)

1. Describe the organization of a typical visual communication industry and its major elements.

2. Relate the systems approach to a specific industry and its operation.

3. Describe the use of the systems approach in industry.

4. Analyze the different variables involved in the systems approach and will create a flowchart showing these variables pictorially.

5. Recall the concept of the systems approach in communication industry.

6. Plan how to reach a goal and devise different approaches to reach this goal.

7. Demonstrate a basic understanding of the systems approach and the differential treatment required for the various media in solving a specific visual communication problem.

8. Analyze different methods of visual communications and demonstrate the ability to decide which of the various methods of visual communications is best adapted to communicating a given concept.

9. Analyze sample projects, using the principles of system analysis and determine if the original goals of the project have been achieved.

10. Use the concepts learned while producing a communication product.

11. Work in groups and cooperate with one another to successfully create, as a team, an end product.

ELECTRICAL
PERFORMANCE INDICATORS
(FOR DISCUSSION ONLY)

CAREERS (goals 1, 7, 8, 9)

1. List the location of several job openings in the electrical industry.
2. List the advancement opportunities available for a selected electrical career.
3. List the requirements which must be met for entry into a selected electrical career.
4. List starting salaries for a selected electrical career.
5. List working conditions for a selected electrical career.
6. Compare personal interests and abilities with those required in selected electrical careers.
7. Identify and use basic career information resources.
8. Prepare a personal "tentative" career and educational plan.

ELECTRON THEORY (goal 3)

1. Illustrate the structure of an atom.
2. Illustrate the structure of a molecule.
3. Illustrate the composition of matter typical of conductors, semi-conductors, and insulators.
4. Explain the basic atomic theory.
5. Identify charges.
6. Explain the theory of electron flow.
7. List and briefly describe how emf is developed in various devices.
8. Identify devices which produce emf.

STATIC ELECTRICITY (goals 2, 3)

1. Explain the nature of static electricity.
2. Produce electricity with friction.

3. List and identify uses of static electricity.

MAGNETISM (goals 2, 3, 6, 7, 8)

1. Identify devices using magnetism to produce electricity.
2. Produce electricity with magnetism.
3. Compare, test, and analyze devices in circuits that use magnetism to do work.
4. Explain motor theory.

CAPACITANCE (goals 2, 5, 6, 7, 8)

1. Identify a capacitor.
2. Determine factors which affect capacitance.
3. Determine the basic operating characteristics when the factors that determine capacitance are varied.
4. Connect a capacitor in a circuit so it operates properly.

RESISTANCE/CONDUCTANCE (goals 2, 3, 5, 6, 7, 8)

1. Identify factors that affect resistance.
2. Compare the current carrying capacity of common conductors.
3. Identify resistors of the carbon, power, and variable type.
4. List the relationship between current and voltage.
5. List the relationship between current and resistance.
6. Identify thermal electrical devices.
7. Produce heat with an electrical current.
8. List common devices that convert electrical energy to light.
9. Explain the processes involved in the conversion of electrical energy to light.
10. Product light energy from electrical energy.
11. Compare various devices producing light energy.

INDUCTANCE (goals 2, 3, 5, 6, 7, 8)

1. Identify an inductor.
2. Identify the factors which affect inductance.
3. Determine the change in the performance of the circuit by changing the factors which affect inductance.
4. Describe the physical construction of a step-up transformer.
5. Describe the physical construction of a step-down transformer.
6. Test a transformer for shorts, continuity, and turns ratio.
7. List common uses of transformers.

VOLTMETERS (goals 2, 4, 5, 7)

1. Identify a voltmeter.
2. Place the voltmeter in the circuit correctly.
3. Measure voltage units accurately.

OHMMETERS (goals 2, 4, 5, 7)

1. Identify an ohmmeter.
2. Place the ohmmeter in a circuit correctly.
3. Measure resistance units accurately.

AMMETERS (goals 2, 4, 5, 7)

1. Identify an ammeter.
2. Place the meter in a circuit correctly.
3. Measure current flow accurately.

TOOLS, MATERIALS, AND EQUIPMENT (goals 2, 4, 5, 7)

1. Identify basic electrical handtools.
2. Use basic hand-tools correctly.
3. Identify basic electrical materials.

4. Use materials properly.
5. Identify basic electrical equipment.
6. Use basic equipment properly.

SEMICONDUCTOR DIODES (goals 2, 5, 6, 7, 8)

1. Recognize a diode.
2. Explain a diode's operating characteristics.
3. Connect a diode in a circuit to operate properly.

TRANSISTORS (goals 2, 5, 6, 7, 8)

1. Recognize a transistor.
2. List several uses of the transistor.
3. Compare its operation with a switch and a relay.
4. Connect a transistor in a circuit to operate properly.

RECTIFIERS (goals 2, 5, 6, 7, 8)

1. Recognize a silicon controlled rectifier and its symbol.
2. Compare the silicon controlled rectifier to a diode.
3. Compare the silicon controlled rectifier to a relay.
4. Explain the operation and use of a silicon controlled rectifier in a circuit.
5. Compare the silicon controlled rectifier to the transistor.
6. Connect a silicon rectifier in a circuit to operate properly.

PIEZOELECTRIC DEVICES (goals 2, 4, 5, 6, 7)

1. Identify uses of piezoelectric devices.
2. Perform experiments using piezoelectric devices.
3. Identify piezoelectric devices.
4. Explain simple piezoelectric circuits.

ELEC-CHEMICAL DEVICES (goals 2, 4, 5, 6, 7)

1. Identify devices using chemicals to produce electricity.
2. Perform experiments using chemicals to produce an electrical current.
3. Compare and test chemical devices that use electric current.
4. Produce a chemical reaction using an electric current.

PHOTOELECTRIC DEVICES (goals 2, 4, 5, 6, 7)

1. Identify photoelectric devices.
2. Perform experiments using photoelectric devices.
3. Explain the characteristics of photoelectric devices.
4. List common uses of photoelectric devices.

THERMOCOUPLES (goals 2, 4, 5, 6, 7)

1. Identify a thermocouple.
2. Generate electricity with heat.
3. Explain the thermoelectric effect.
4. List common devices that use thermocouples.

SWITCHES (goals 2, 5, 6, 7, 8)

1. Identify push-button N.O. (Normally Open) and N.C. (Normally Closed).
2. Identify SPST switch.
3. Identify SPDT (3-way) switch.
4. Identify DPDT (4-way) switch.
5. Identify DPST switch.
6. Predict common switch controlled circuit operation.
7. Identify a magnetic switch which operates when electricity is applied.
8. Explain how one relay permits multiple control.

9. Compare the similarity of a circuit breaker and a relay.
10. Connect common switch controlled circuits in the proper manner.

CIRCUITRY (goals 2, 5, 6, 7, 8)

1. Explain a complete circuit and name the four main parts.
2. Compare and analyze a complete and incomplete circuit.
3. Identify a series circuit.
4. Identify a parallel circuit.
5. Trace the current path in a series circuit.
6. Trace the current path in a parallel circuit.
7. Identify voltage relationships in a series or parallel circuit.
8. Connect a series circuit so it operates properly.
9. Connect a parallel circuit so it operates properly.
10. Connect a compound circuit so it operates properly.

ELECTRICAL SYSTEMS (goals 2, 3, 5, 6, 7, 8)

1. Recognize the basic components of electrical systems as they relate to this course.
2. State the common characteristics of electrical power systems and the laws that apply to them.
3. Connect a simple electrical system so it operates properly.

METALS PRODUCTS
PERFORMANCE INDICATORS
(for discussion only)

The student will:

CAREERS (goals 1, 8, 9)

1. Given the metals career cluster guide list and describe five key metalworking jobs.
2. Relate personal interests and abilities to the work requirements for a selected metalworking job.
3. Using a local newspaper help wanted column, cut out advertisements about metalworking job openings.
4. Write a letter of application for a selected metal-working job opening.
5. Given job training catalogs describe, in writing, the courses required for graduation.
6. Interview a selected metalworker and list the tasks he performs on his job.

METAL PROPERTIES AND TERMINOLOGY (goals, all)

1. Differentiate among the terms ferrous, non-ferrous, elements, and alloys.
2. Itemize distinguishing characteristics of various metals.
3. Correctly label six metal coupons by subjecting them to visual, weight, magnetic, bend and spark tests.
4. Given two descriptive phrases and the terms iron and steel, correctly match them.
5. When given the term "reduction" recall the following corresponding phrases: making iron, blast furnaces, and removing oxygen.
6. Identify the meaning of each digit of the steel coding system.
7. Select the names of alloying elements that give steel certain properties.
8. When given the term "oxidation," will recall the following corresponding phrases: making steel, open-hearth, oxygen converter, electric arc, and adding oxygen for the purpose of removing carbon.

9. Identify the meaning of and process for obtaining: hardness, annealed condition, temper, case hardening, and flame hardening.

10. Contrast the characteristics of pure aluminum and alloy aluminum.

11. Itemize the properties of pure aluminum.

12. Describe how aluminum is extracted and refined.

13. Identify aluminum alloys by matching the alloy name with the alloy number.

14. Enumerate at least six physical properties of metals.

EXPERIMENTS (goals, all)

1. When given the required materials, tools, and equipment, successfully complete four experiments: (1) thermal conductivity, (2) magnetic properties, (3) thermal expansion, and (4) cold working and annealing.

FOUNDRY (goals, all)

1. Select an appropriate definition for hot casting from a list of four possible alternatives.

2. Describe the basic requirements of foundry patterns.

3. Ram-up and pour an aluminum part with a match plate pattern and green sand.

FORGING (goals, all)

1. Select an appropriate definition for forging from a list of four alternatives.

2. Describe the characteristics of a forged part.

3. Forge a screwdriver blade with a drop forge.

4. Properly temper the screwdriver blade by observing the temper colors.

SHEET METAL (goals, all)

1. Indicate the value of explosive forming as compared to spinning, stamping, and casting.

2. Select an appropriate definition of explosive forming from a list of four alternatives.

3. Recite safety precautions prior to any explosive forming lab activity.
4. Construct project(s) using common joints, solder and rivet where necessary.
5. Make layout for a box and a funnel.

SPINNING (goals, all)

1. Select, from a list of four alternatives, the appropriate definition of spinning.
2. Describe the characteristics of metal stamped parts.
3. Describe characteristics of spun parts.
4. Stamp and spin an aluminum product.

MACHINING (goals, all)

1. Select an appropriate definition of machining from a list of four alternatives.
2. Enumerate at least five characteristics of machined products.
3. Itemize and describe the five basic machining processes.
4. Machine an aluminum casting on a vertical mill.
5. Band saw an aluminum 1/4" plate to correct size.
6. Product a mold sprue hole on a drill press.
7. Chemically etch metal and show correct use of resist.

FINISHING (goals, all)

1. Finish metals by forming, separating, and combining processes.
2. List four reasons for applying a finish to metal.
3. List two reasons for applying a primer coat.
4. Spray a primer coat according to specification standards.
5. List the reasons for applying the finish before and after assembling parts.
6. The student will mask off areas to be left free from paint.
7. The student will spray the final coat and store for drying purposes.

POWER
PERFORMANCE INDICATORS
(FOR DISCUSSION ONLY)

CAREERS (goals 1, 7, 8)

1. Identify the different career opportunities available in the power and energy field.

2. Contrast and compare between educational needs for various jobs in the power and energy field.

3. List several jobs which interest him in the two areas (mechanics, and fluids) which he may desire to follow up later in studying.

4. Contrast and compare between working conditions of various jobs in the power and energy field.

5. List starting salaries of several jobs in the mechanics and fluid areas.

6. List several sources where information about careers in the power field may be found.

7. Compare personal success in completing assignments with work requirements in selected areas.

NATURAL ENERGY SOURCES (goals 3, 4, 5)

1. List several types of natural energy sources and explain how they are harnessed or transformed into usable energy.

2. Identify specific problems encountered through the use of organic fuels and natural resources used in energy consumption and conversion.

3. Identify the constituents of photochemical smog and how the pollutants are formed from basic fuels.

4. Identify non-atmospheric pollutants.

5. List three kinds of fossil fuels and state advantages and disadvantages of each.

6. Compare nuclear fission and fusion, and explain basic atomic chain reaction.

7. List several effects of the use of energy resources on the country and its people.

8. List several different fuels distilled from crude oil.

SIMPLE MACHINES (goals 2, 3, 4, 5)

1. Identify each of the three types of levers.
2. Demonstrate how each is used to gain mechanical advantage.
3. Identify the wheel and axle, the pulley, the inclined plane, the screw, and the wedge as simple machines.
4. Demonstrate or write how mechanical advantage is gained in each type of simple machine.
5. Identify a first class lever.
6. State how mechanical advantage is gained or lost in using the first class lever.
7. List several simple machines and their application to the past, present, and future.
8. Recognize the uses of simple machines and tell how man has benefited by their uses.
9. Recognize the uses of these simple machines in the more complex machines of today.

RECIPROCATING INTERNAL COMBUSTION ENGINE (goals 2, 3, 4, 5, 7)

1. Identify at least four types of reciprocating internal combustion engines.
2. Write the basic principles of operation of the two- or four-stroke reciprocating engine.
3. Identify key parts of the reciprocating internal combustion engine. A list of the key parts includes: cylinder block and head, the combustion chamber, the cylinder, pistons and piston rings, the connecting rod, a camshaft on a four-cycle engine, a crankshaft, the carburetor, a four-cycle engine, and a two-cycle engine.
4. Write at least two of the three engine accessory systems that we study, including being able to identify at least three major parts of these two systems.
5. Write the difference between volumetric and brake thermal efficiency.
6. Demonstrate the ability to perform basic service operations on a two and four stroke engine.

ROTARY COMBUSTION ENGINE (goals 2, 3, 4, 5, 6)

1. Explain the concept of the rotary combustion engine using a transparent model of the engine as a guide.
2. Identify pictures of the rotor, the housing, the intake and exhaust port, and the end covers of the rotary combustion engine.
3. Perform basic service operations properly.

AIR STREAM ENGINE (goals 6, 7)

1. Write Newton's Third Law of Motion, which states that for every action there is an equal and opposite reaction.
2. Write the basic operating principles of the reaction air stream engine.
3. Recognize the operational differences between the turbojet engine, the turboprop engine, and the turbofan engine.

GAS TURBINE (goals 6, 7)

1. Write the basic principles of operation of the gas turbine engine.
2. Identify the basic parts of the gas turbine engine: the compressor, the combustion chamber, the compressor turbine, the power turbine, the regenerator.

ROCKETS (goals 6, 7)

1. Write the differences between a reaction air stream engine and a rocket engine.
2. Write the two basic classes of rockets.

STEAM TURBINE (goals 6, 7)

1. Write the basic operating principles of the steam turbine, including an explanation of the high pressure stage and the low pressure stage turbine wheels.
2. List two or more applications of the steam turbine.

MECHANICAL TRANSMISSION (goals 2, 3, 4, 5, 7, 8)

1. Demonstrate ability to increase speed and decrease torque (or decrease speed and increase torque) by either changing the sizes of pulleys or chain sprockets, or by describing the action on paper.

2. List two advantages and two disadvantages of the chain drive.

3. List two advantages and two disadvantages of the belt drive.

4. List four applications of both the belt and the chain drive.

5. Identify three basic types of gears from the following list: spur, helical, worm, bevel.

6. Demonstrate his ability to increase speed and decrease power or decrease speed and increase power by changing the sizes of the gears on the input or output shaft by either writing it on paper or actually making the changes on a demonstration unit.

7. Write the purpose of the clutch.

8. Recognize at least three types of clutches.

9. Explain the operating principles of at least one type of clutch.

MECHANICAL SYSTEMS (goals 2, 3, 4, 5, 6, 7)

1. Recognize the basic components of mechanical systems as they relate to this course.

2. State the common characteristics of mechanical systems and the laws that apply to them.

3. Demonstrate the ability to connect basic components into a mechanical system properly.

FLUID POWER SYSTEMS (goals 6, 7)

1. Compare the difference between a liquid and a gas.

2. Relate why a study of fluid power is necessary.

3. Compare and contrast fluid movement with electrical and mechanical movement.

4. Identify uses of fluid power.

5. Recognize the basic components of the hydraulic system.

6. State the characteristics of fluids and the laws that apply to them.

7. List examples of simple hydraulic applications.

8. Define pneumatics.

9. Recognize uses for pneumatics.

10. Identify laws controlling pneumatic use.
11. Describe the basic cycle of a refrigeration unit.
12. List applications of refrigeration units.
13. State how hydraulic and pneumatic systems are alike.
14. List any differences in the two systems.
15. Define vacuum.
16. Recognize where vacuum is used.
17. Explain how the movement of air to fill a vacuum does work for us.

SUBSYSTEMS/COMPONENTS (goals 2, 3, 4, 5, 6)

1. List the individual parts of the hydraulic system (input).
2. Explain how these parts work together.
3. Compare the hydraulic (input) sources to mechanical and electrical (input) sources.
4. List the individual parts of the pneumatic (input) components.
5. Explain how these parts work together.
6. Differentiate between pneumatic sources and hydraulic sources.
7. Identify the most common types of direction flow valves.
8. Explain orally which two-way valve would be more suitable for a certain application and why.
9. List the parts of a two-way valve.
10. List all the components that are protected by relief valves in a fluid system.
11. Adjust relef valves to a given pressure.
12. Explain the downstream side of a pressure reducing valve and state where this type valve is used.
13. Differentiate between a back-pressure check which opens at a given pressure and those that open as soon as flow begins.
14. Compare check valves with valves that have an adjustable orifice.
15. Identify the various checking mechanisms.

16. Construct an open-end manometer and use it to measure pressure.

17. Contrast a bourdon tube pressure gauge with a manometer and list data.

18. Solve problems using the hydrometer and the manometer to secure data.

19. Identify which type meter would be best to use for measuring the flow in a particular system.

20. List the different types of cylinders.

21. Differentiate between types of cylinders.

22. Solve problems of thrust.

23. Identify the variety of materials used depending upon the pressure contained within the fluid power system.

24. Correctly identify when to use pipe sealer or a synthetic O-ring for sealing a system.

25. Identify the different types of connections and fittings used in fluid power systems so that proper repair and maintenance could be completed.

26. Define actuator, reciprocating motion, and rotary motion.

27. Compare the operation of a fluid coupling and a torque converter.

28. Describe the basic principle of a water turbine.

29. Name the basic parts of a power steering system.

30. Explain how the power steering functions.

31. Describe how the fluid or air is used to cause movement to slow or stop a vehicle.

32. Define the meaning of fluid power as it relates to this course.

33. Recognize the basic components of fluid power systems.

34. State the common characteristics of fluid power systems and the laws that apply to them.

COMBINED SYSTEMS (goals, all)

1. Recognize the various control devices used in industry or which are encountered in doing your own thing.

2. Trace the historical development of control devices used to control machinery found in combined systems.

3. List the major historical developments that led to the present day use of combined systems in industry.

4. Define feedback and relate how it effected the development of automation.

5. Compute the cost of materials of a given product.

6. Compute the time to manufacture this given product by using hand methods only and by machine methods.

7. Estimate the cost of machines to manufacture each of the parts of the given product.

8. Calculate the cost break even point of manufacturing by hand method and by machine method.

9. Demonstrate how the studied system operates.

10. Show how each control device will operate in the studied system.

11. Assemble from laboratory equipment a small model of a lift or elevator operated by a fluid system.

12. Measure breakaway pressure, moving pressure, input distance moved and output distance moved, and to calculate the mechanical advantage of distance for the system.

13. Identify and write the symbol for the devices used in combined systems.

14. List the types of systems studied thus far in the course and relate some common uses of each.

15. Evaluate the various systems using only the information given thus far in the course.

16. Assemble from laboratory equipment a fluid-mechanical assembly that will automatically control the motion in a system.

17. Record the effect of varying the air pressure and the gear ratio used to operate this system.

18. Assembly from laboratory equipment a fluid-mechanical assembly that will produce continuous and rapid reciprocating motion.

19. Observe and record the effect on the system of changing the operating pressure.

20. Identify the types of automatic system and name which of the three power systems are involved in various simple and complex automatic systems.

21. Assemble from laboratory equipment an electric motor driven system that can be shifted in and out of operation by the use of fluid controls.

22. Record the effect of changing air pressure and position of switches on this system.

23. Combine a variable speed air cylinder with an existing fluid-mechanical system and observe the phasal relationship between motor and cylinder.

24. Assemble a duplicate of the fluid-mechanical system substituting electrical devices for all fluid devices.

25. Record the effect of varying the voltage used to operate this system.

26. Contrast the way man accomplished various things in his life, such as transportation, food processing, and manufacturing in the early 1900's, 1930's, present, and future possibilities.

AUTOMATIC SYSTEMS (goals, all)

1. Relate the advantages and disadvantages of automatic systems that are used in industry.

2. Contrast the pros and cons of the effect of automation on our industrial society.

3. Describe five of the manufacturing techniques involved in the industrial use of automatic systems.

4. Relate the type of interrelationship between electrical-fluid-mechanical power systems involved in these manufacturing techniques.

5. Identify mechanical, fluid, and electrical systems used in combination to perform combined machine operations.

6. Compare the three power systems in terms of why they have been selected to perform specific functions common to everyday life.

7. Identify manual, semi-automatic, and automatic devices involving combinations of mechanical, fluid, and electrical systems.

8. State advantages and disadvantages of automation.

PLASTICS/SYNTHETICS
PERFORMANCE INDICATORS
(FOR DISCUSSION ONLY)

CAREERS (goals 1, 8, 9)

1. Given a list of ten occupations, select five which represent key jobs in the plastics/synthetics industry.
2. List major cities or areas where jobs in the plastics/synthetics industry may be found.
3. List at least five skills learned in this class that are used by persons employed in the plastics/synthetics industry.
4. Secure and complete a W-F form.
5. Describe, in writing, the current supply and predicted need for workers in the plastics/synthetics industry.

CHARACTERISTICS (goals 2, 7)

1. Indicate the four elements which make up the definition of plastics materials.
2. Describe the thermoplastic characteristics.
3. Describe the thermosetting plastics characteristics.
4. Describe the significance of the historical dates of 1868 and 1909.
5. Given a list of ten materials, some organic and some inorganic, select four which are used as raw materials in the making of plastics materials.
6. Given a list of ten elements, identify four elements which are found in many plastics materials.
7. Draw a diagram of the elemental structure of a simple polymer.
8. Given a list of ten descriptive phrases, identify four phrases which comprise the definition of plastics.
9. Given four descriptive phrases, identify the phrase which most accurately describes the term thermoplastic.
10. Given four descriptive phrases, identify the phrase which most accurately describes the term thermosets.
11. Given the dates 1868 and 1909, write the developer's name, the plastics he developed, and the circumstances associated with the developments.

12. From the list of ten unique characteristics of plastics discussed, recall at least six from memory.

13. Given styrene, ABS, acrylic, nylon, polyethylene, polyvinyl chloride, urethane foam, phenolic, and butyrate, chart the characteristics of the plastics samples when subjected to the five tests of the chart.

14. Describe the procedure used for identification of plastics.

FABRICS (goals 5, 7, 8)

1. Given ten fabrics, identify the style of construction of at least eight fabrics.

2. Given a list of twelve fibers, recall at least four natural fibers and four man-made fibers.

RUBBER (goals, all)

1. Given a list of six synthetic rubbers and after a fifteen minute study period, correctly spell at least four synthetic rubbers.

2. Discuss the historical development of natural and synthetic rubbers.

3. Given six samples of rubber, identify each sample, enumerate their properties, and mount them on a heavy paper plaque.

4. From a list of four possible definitions, select the best definition of rubber.

5. Itemize three unique characteristics of rubber.

6. Explain, in writing, how a tire is manufactured.

7. Given a procedure sheet, begin work on a pair of wooden clogs that have rubber tread soles.

8. Discuss historical and current developments in rubber tires.

9. After observing a demonstration of the vulcanization of rubber, itemize the essential components and processing steps necessary for the process.

10. After review of rubber, list major uses for six kinds of rubber.

11. Recite the names and descriptions of the two recapping processes.

12. Using a clog as a product, complete the sequential steps of laying out the pattern, shaping the upper wooden part of the clog, rough sanding the shoe, adhering clog base to the sole and heel, and then attaching all parts together to form product.

13. Use the band saw and disc sander in a safe manner.

VINYL (goals, all)

1. Given a list of several possible definitions, recognize a suitable definition of leather and supported vinyl.

2. Given the instructions to sand a sample of wood and a sample of rubber, compare and contrast the abrasive characteristics of the materials.

ROTATIONAL & BLOW MOLDING (goals, all)

1. Describe the characteristics of rotational and blow molded parts.

2. Select appropriate definitions for rotational and blow molding, each from a list of four alternatives.

3. Rotationally mold at least one ornamental fruit product from wax.

4. Blow mold a polyethylene bottle.

REINFORCING (goals, all)

1. Given four descriptions select an approprate definition of reinforced plastics.

2. Describe the characteristics of reinforced plastics products.

3. Match description of processing methods with corresponding names.

4. Given the necessary tools and supplies produce a model boat hull comprised of two layers.

COMBINING (goals, all)

1. Identify three principle uses for cellular materials.

2. Compare and contrast polystyrene and urethane foam manufacturing processes.

3. Weigh, mix, stir, and pour urethane components.

4. Adhere the boat deck, dagger board, and hull with urethane resin.

DRAPE FORMING AND CASTING (goals, all)

1. Compare and contrast forming glass with forming acrylic.

2. Indicate advantages of synthetic stained glass.

3. Form acrylic by draping over a male form.

4. Will cast a synthetic stained glass window of polyester.

THERMOFORMING (goals, all)

1. When given four possible definitions, choose the most appropriate definition.

2. Describe characteristics of thermoformed product.

3. Match thermoforming processing method descriptions with the corresponding names.

4. Thermoform a model boat deck of styrene over a male mold.

THERMAL CUTTING (goals, all)

1. Define thermal cutting by selecting an appropriate definition from a list of four alternatives.

2. List three safety measures to be taken during cutting operations.

3. Cut polystyrene foam with a hot wire.

SHEARING (goals, all)

1. Determine which shear is best for cutting .060" ABS plastics sheet.

2. List common hand and machine tools used for shearing.

3. Shear .060" ABS plastics sheet to specified squareness and size.

POLISHING (goals, all)

1. Define the term abrasive by selecting an appropriate definition from a list of four alternatives.

2. Name and describe three commonly used abrasives.
3. Use an abrasive wheel to trim decorative laminate.

CHEMICAL ETCHING (goals, all)

1. Define the term etching by selecting an appropriate definition from four alternatives.
2. Indicate applications where etching is commonly practiced.
3. Indicate unique characteristics of etching as compared to other separating processes.
4. Produce a printed circuit board by chemical etching.

INDUSTRIAL CRAFTS
PERFORMANCE INDICATORS
(FOR DISCUSSION ONLY)

The student will:

CAREERS (goals, 1, 7, 8)

1. Given the Encyclopedia of Careers, list at least five jobs which require their workers possess skills similar to those developed in this class.
2. Describe the habits and attitudes required of people employed in a selected job.
3. Prepare a written resume of personal educational and work experience.
4. Write out the costs involved in getting training for entry into a selected job.
5. Write out a career plan detailing goals and procedures.
6. List the career clusters offered ~~in your~~ school ~~district~~ which further develop skills and knowledges learned in this class.

LAPIDARY (goals, all)

1. Select an appropriate definition of stone from a list of four possibilities.
2. Explain how igneous, sedimentary, and metamorphic stones are made.
3. Perform operations of sculpturing and polishing.
4. List at least six uses of stone.
5. Given six stones, identify them by name, describe their characteristics, and mount them.

CERAMICS (goals 2, 7)

1. Differentiate the terms "clay" and "ceramic."
2. Identify in writing the names of at least six ceramic products.
3. Describe the unique properties of ceramic materials as compared to other materials such as metals, plastics, woods, and rubbers.
4. Match the names of at least three types of clays with a description of their common uses.

GLASS (goals, all)

1. Identify at least six of the ten chemicals used in glass.
2. Choose the correct definition of glass from a list of four alternatives.
3. Match the descriptions of glasses with their corresponding names for the following three types: (a) quartz, (b) soda-lime glass, and (c) borosilicate glass.
4. Given only two attempts, cut a piece of glass by using a glass cutter and steel rod.

CONCRETE (goals, all)

1. Correctly match the terms "concrete" and "cement" to the corresponding descriptions.
2. Describe four major properties of concrete.
3. Itemize the variables which determine the strength of cured concrete.
4. Riddle 1/2" and 3/4" aggregate properly.
5. Given necessary materials and equipment, mix concrete and perform a slump test.
6. Given concrete from completed slump test, cast four concrete test beams with various reinforcements and two test cylinders.

PLASTER (goals, all)

1. Describe how raw plaster is produced.
2. Enumerate four uses for plaster.
3. Indicate three ways to form plasters.
4. When given the needed supplies, make a small wood and clay pattern according to specifications.

LEATHER (goals, all)

1. Create a design suitable for application to a leather project.
2. Transfer a design to leather using appropriate techniques.
3. Cut leather to within acceptable dimensions.

4. Prepare leather for tooling.

5. Given appropriate tools, tool a design in leather.

6. Stain leather according to acceptable practices.

7. Given a "five" in one punch; punch holes, set eyelets, and slit holes.

8. Fasten snap fasteners and buttons.

9. Given appropriate tools, rivet snap buttons to a leather product.

10. Given appropriate tools, lace a leather product using the button-hole stitch.

11. Finish a leather product using appropriate techniques.

12. Calculate the cost of selected products to within ± 1% of real cost.

JEWELRY (goals, all)

1. Transfer a design to metal in preparation for cutting operation.

2. Select appropriate blades for the jeweler's saw and cut metal to within acceptable dimensions.

3. Select and use the proper file for a given piece of work.

4. Select and use appropriate abrasive cloths and papers to obtain a smooth finish.

5. Join two metals by the use of a third metal (soft solder).

6. Join two metals by the use of hard solder.

7. Clean metal surfaces through the use of pickling solutions.

8. Soften metal by heating it.

9. Perform buffing and polishing operations according to acceptable standards.

10. Preserve the finish on a piece of jewelry by applying lacquer.

11. Apply an antique finish to a piece of jewelry by using an oxidizing solution.

12. Give depth and richness to jewelry by using domes or hemispheres of metals.

13. Bring a design out of a metal surface, into low, or bas-relief, by the use of chasing or repousse'.

14. Calculate the cost of selected products to within 1% of actual cost.

Project #RE-3-74

INDUSTRIAL CAREER EXPLORATION PROGRAM

(For Discussion Only)

PONDEROSA JUNIOR HIGH SCHOOL (KLAMATH FALLS)
SEVENTH AND EIGHTH GRADES

PREPARED BY:
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Tentative Program Goals

A study of industrial arts serves these purposes:

1. Enables students to understand the concepts, principles, generalizations, problems, and strategies of industrial technology.
2. Encourages an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants for those goods.
3. Provides knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and socio-cultural significance.
4. Enables students to demonstrate habits necessary to function effectively in selected career areas.
5. Assists students in recognizing the importance of positive attitudes toward work.
6. Helps students maintain acceptable inter-personal working relationships.
7. Helps students make appropriate, "tentative" career decisions.

Tentative Course Goals--Seventh Grade

This course will enable the student to do the following:

1. Perform work in a manner safe to himself and others.
2. Demonstrate responsibility for punctuality and regular attendance at work.
3. Understand the importance of attitudes that people have toward work.
4. Demonstrate the behaviors that signal a willingness to cooperate with others on work assignments.
5. Demonstrate correct job application procedures.
6. Identify career fields most closely related to personal interests and abilities.
7. Demonstrate ability to plan a personal educational program for those career areas requiring training beyond high school.
8. Place manufacturing technology in the broader contest of industrial technology and all of technology.
9. Be aware of the history, present character, and future of the manufacturing phase of industry.
10. Appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to manufacturing procuection systems.
11. Appreciate, understand, and perform selected personnel practices in pre-processing, processing, and post-processing or servicing as they apply to manufacturing production systems.
12. Appreciate, understand, and perform selected production practices in pre-processing, processing, and post-processing or servicing as they apply to manufacturing production systems.
13. Appreciate and understand the inter-relationships within and between management, personnel, and production practices.
14. Appreciate and have some understanding of manufactured products and the tools and materials utilized in their manufacture.
15. Utilize the knowledge and skills of manufacturing management and production to investigate factors involved in the manufacture of representative products.
16. Develop an awareness of vocations in manufacturing industries.

Tentative Course Goals--Eighth Grade

This course will enable the student to do the following:

1. Perform work in a manner safe to himself and others.
2, Demonstrate responsibility for punctuality and regular attendance at work.
3. Understand the importance of attitudes that people have toward work.
4. Demonstrate the behaviors that signal a willingness to cooperate with others on work assignments.
5. Demonstrate correct job application procedures.
6. Identify career fields most closely related to personal interests and abilities.
7. Demonstrate ability to plan a personal educational program for those career areas requiring training beyond high school.
8. Place construction technology in the broader context of industrial technology and all of technology.
9. Appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to construction production systems.
10. Appreciate, understand, and perform selected personnel practices in planning, organizing, and controlling as they relate to construction production systems.
11. Appreciate, understand, and perform selected production practices in pre-processing, processing, and post-processing or servicing as they apply to construction production systems.
12. Appreciate and understand the inter-relations within and between management, personnel, and production practices.
13. Appreciate and have some understanding of constructed projects and the tools and materials utilized in their construction.
14. Utilize knowledge of construction techniques outside the classroom, currently and in the future.
15. Understand the inter-relationships of construction technology and community development.
16. Develop an awareness of vocations in construction technology.
17. Develop an awareness of the significance of construction technology in the past, present, and future.

PERFORMANCE INDICATORS
(Seventh Grade)

As a result of their learning experiences, the students should be able to do the following:

Introduction (Goals: All)

1. Given the course organization and content:
    a. Name some of the student activities in the course.
    b. Name the books they will use in the course and explain how, when, and where each is to be used.
    c. State how a concept is studied in this class.
    d. State what the homework assignment is and how and when it should be done.
2. Given a class section of junior high school students, organize and structure the class section into groups which contain a foreman, a timekeeper, a recorder, an equipment supervisor, and a safety supervisor.
3. Given a set of laboratory manuals, code the materials for efficient distribution.

Man and Technology (Goals: 8, 9, 16)

1. Given information related to man and technology:
    a. Name some leadership jobs in each of the institutions of society and name some of the responsibilities of the leaders.
    b. Describe how you benefit from the activities of each institution of society.
2. Given the text reading and a presentation:
    a. Name the five basic social institutions of man.
    b. In their own words, explain each of these institutions.
3. Given a pound of clay, imitate the technology of primitive man by hand-forming a simple container for water.

Accident Prevention (Goals: 1, 3, 4)

1. Given information related to establishing accident prevention programs:
    a. Give reasons why a large company would be more interested in promoting occupational health and safety programs for its workers than a small company.
    b. Explain why it is easier to plan accident controls for machines than it is for people.

2. Given a list of five unsafe working conditions, list appropriate protective equipment to protect the worker from these unsafe conditions.

3. Given a checklist of 28 items relating to safety in a school laboratory:

    a. Inspect the industrial arts laboratory and show on the checklist whether or not their school laboratory provides for the listed items.

    b. Suggest corrective action to maintain safe working conditions.

4. Given a list of unsafe conditions and devices to protect workers against the conditions, match each unsafe condition with a suitable protective device.

5. Given nine photographs showing unsafe working conditions:

    a. Identify the unsafe conditions.

    b. State the corrected conditions.

Employment and Occupations (Goals: 2, 3, 5, 6, 7, 16)

1. Given a reading about employment and occupations in manufacturing:

    a. Discuss how managers add value to products.

    b. Explain why service and government employees will increase the most from 1966 to 1975.

    c. Determine if manufacturing employees will increase or decrease.

2. Given the terms "durable goods" and "nondurable goods", contrast the distinguishing characteristics of each product group and name six manufacturing areas in each class.

3. Given the presentation, name the occupation groupings of production workers and managerial groups.

4. Given the terms "data division", "people division", and "things division", differentiate among the three as used in job descriptions.

5. Given situations related to hiring and training:

    a. Explain why an employer would want to look at an applicant's school transcript before hiring him.

    b. Discuss how you might learn the wrong things if you were getting on-the-job training from an experienced employee.

6. Given a series of questions:

    a. Name the three basic steps in hiring new employees.

    b. Explain the difference between within-plant recruiting and out-of-plant recruiting.

c. Name some techniques and devices for selecting workers.

7. Given an employment application form, complete the form as indicated and compete for a job.
8. Given several job applicants, help choose the one best qualified for the job opening.
9. Given descriptions of various businesses, the student can predict the effect of tardiness or poor attendance on the operations.
10. The student will be able to maintain a record of punctuality and regular attendance at school.
11. Given an essay assignment, the student will be able to explain the relationship of personal attitudes to achievement.
12. Given an essay assignment, the student will be able to explain the relationship between productive work and out economic system.
13. In a simulated or real committee meeting, the student will share ideas and accept responsibility for completing a group project.
14. Given a simulated employment interview, the student will demonstrate acceptable posture, dress, personal grooming, and facial expression.
15. Given proper guidance, the student will be able to match personal skills and experience with several occupations in his chosen career field.
16. Given an essay assignment, the student will be able to relate the life styles of people who work in different career environments to personal interests and preferences.
17. Given the assignment, the student can:
    a. Locate sources of information concerning training requirements for various professional occupations in the career area of his choice.
    b. Locate post-high school institutions which would meet his identified training needs.

Manufacturing Personnel Technology (Goals: 6, 11, 16)

1. Given information about manufacturing personnel technology:
    a. Determine how a worker should be selected for a job when there are several qualified applicants for the job.
    b. List the rules (regulations) under which your father works at his job and compare them with the rules in your school.
2. Given a presentation on manufacturing personnel technology:
    a. Name the three technologies of manufacturing.

   b. Name five basic kinds of personnel practices in manufacturing firms and one subdivision of each kind.

3. Given twelve pictures, name the basic kind of personnel practice and the subdivision or specific practice shown in each one.

Identifying Consumer Demands (Goals: 10, 15)

1. Given information related to identifying consumer demands:
   a. Discuss how you would inform a manufacturer that you do not like his product.
   b. Determine if your parents have been involved in a consumer study and, if so, the type of study and where it took place.
2. Using the data gathered during the laboratory activity, decide what the data mean to a company considering production of the product.
3. Using the forms provided, conduct an in-class consumer survey, tabulate the data, and complete a market research report.

The Evolution of Manufacturing (Goal: 9)

1. Given information about the evolution of manufacturing:
   a. Imagine that wheels, printing presses, and ways of purifying water disappeared completely. State how your life would change.
   b. Identify what new goods or new ways of producing goods would help people most.
2. Given the text reading and presentation:
   a. Name some of man's earliest kinds of skill and knowledge.
   b. State where the first permanent societies developed, what kinds of knowledge developed there, and which part of Europe first learned advanced technological skills.
   c. Explain in their own words the Renaissance and the Industrial Revolution.
3. Given clay and their personal inventiveness, imitate an early type of manufacture by:
   a. Choosing a clay product to produce.
   b. Choosing a production process.
   c. Organizing so that each worker has a specialized production task.
   d. Manufacturing the product.

Manufacturing and the Economic System (Goal: 8)

1. Given information related to manufacturing and the economic system:

- a. State whet you could do, as a consumer, if a company's products became poorer in quality than you wanted them to be.
- b. State what a company could do if its natural resources were used up or no longer available.

2. Given the text reading on Manufacturing and the Economic System:
    - a. Explain the nature of a free enterprise system.
    - b. State how the demand for a product affects the supply.
    - c. Explain how goods are classed as durable or nondurable.
    - d. Give an example of an input-process-output system.
    - e. Name several kinds of goods and services that are included in figuring the value of the Gross National Product.
3. Given the necessary equipment and supplies, produce a coat hanger by a custom production system.
4. Given the experience of mass-producing coat hangers by a managed production system, compare this with previous experience in custom production.
5. Given the problem of manufacturing a quantity of coat hangers, perform one specialized task in the production of a coat hanger.

Basic Machine Tools (Goals: 7, 12, 14, 15, 16)

1. Given information about the story of basic machine tools:
    - a. List five parts of an automobile that were manufactured using basic machine-tool techniques, special machine-tool techniques, and a combination of basic and special machine-tool techniques.
    - b. Explain what courses you would take in high school and beyond high school that would help prepare you to enter the macnine-tool industry.
2. Given six basic kinds of processes performed by machine tools, identify the principle of each process and give an example of each.
3. Given illustrations of five basic machining practices and the corresponding names in a separate column:
    - a. Match each illustration with the proper name.
    - b. Name three practices not shown.
    - c. Identify three descriptions that apply to machine tools.

Primary Metal Products (Goals: 12, 14, 14, 16)

1. Given a story about primary metals:
    - a. Discuss how product designers were involved in the creation of steel foil.

   b. Explain why research and development personnel are important to the iron and steel industry.

2. Given a demonstration on producing standard stock, explain the following:
   a. How impurities are removed from lead.
   b. Why sand is used for casting molten metal.
   c. How metal slabs are formed into sheet stock.
3. Given a simulated raw material, lead:
   a. Melt the lead.
   b. Remove impurities.
   c. Cast the molten lead into a cavity.
   d. Roll the cooled lead into sheet stock.

Rubber Products (Goals: 12, 14, 14, 16)

1. Using information about the story of rubber products:
   a. List all of the products you used today that are made of rubber or that contain rubber parts.
   b. Name some products or components that are now made of another material that might be replaced by rubber or rubber parts.
2. Using a filmstrip, "Story of Tires", demonstrate comprehension of how tires are made by correctly answering at least five of six questions related to the filmstrip.
3. Given the necessary equipment and supplies, manufacture balloons, a dipped rubber product.

Printed Products (Goals: 12, 14, 15, 16)

1. Given information about the story of printed products:
   a. Name ten products other than newspapers, books, and magazines that carry printed information.
   b. Name the four basic kinds of printing processes and under each process list three products in the home that use each process.
2. Given four transparencies on printed products:
   a. Name several products in the laboratory that have printing.
   b. Name five major groups of printed products and give examples of each.
   c. Name four major types of printing and a characteristic of each.
   d. Name the six principal steps to manufacture a printed product.

3. Given the supplies and equipment, print, fold, collate, bind, and trim a multi-page autograph booklet.
4. Each student will produce photographic media materials that will present the idea in such a manner so as to communicate with the selected receiver.
5. Each student will produce photographic media materials utilizing various reproduction methods.
6. Each student will demonstrate ability to adjust and operate photographic imaging devices.
7. Students will learn procedures of developing and enlarging black and white prints.
8. Students will compose a series of color slides to tell a story.
9. Each student will demonstrate the ability to assemble an appropriate image carrier for the various printed media.
10. Each student will list and discuss the various methods of transferring the image by conventional printing methods.
11. Each student will operate successfully all equipment necessary for reproduction of a given message.

Petroleum Products (Goals: 12, 14, 15, 16)

1. Given a story about the production of petroleum:
    a. Explain why petroleum is a nonreproducible mineral resource.
    b. List the petroleum and petrochemical products used in your home.
2. Given a demonstration on reprocessing contaminated oil, name the three practices used to remove physical impurities from the oil.
3. Given a quart of contaminated oil, reprocess the oil by filtering, magnetic cleaning, and siphoning.

Manufacturing Technology (Goals: 6, 12, 14, 15, 16)

1. Given the necessary equipment and supplies, manufacture model rocket airframes, nose cones, launch lugs, and fins for each member of the group.

Manufacturing Management Technology (Goals: 6, 10)

1. Given information related to manufacturing management technology:
    a. Give examples of long-range and short-range planning that your family does.
    b. Describe how a homework assignment is controlled by a teacher and by a student.
2. Given the necessary equipment and supplies:
    a. Cut parts for and assemble a parachute for each member of the group.

   b. Attach a shock cord on each airframe-fin subassembly.
   c. Shape, assemble, and apply finish to a nose cone subassembly for each member of the group.
   d. Reinforce fins and apply a finish coat to the airframe-fin-shock-cord subassembly.

Researching and Developing (Goals: 6, 12, 13, 14, 16)

1. Given situations related to researching and developing:
   a. List the kinds of research and development which would go on in a major automobile manufacturing company.
   b. Discuss ways in which the results of research have more than paid for its cost.
2. Given a presentation on researching and developing:
   a. State the main goals of research and development.
   b. Explain the three main ways of doing research: retrieving, describing, and experimenting.
3. Given land speed record data, retrieve and record information.
4. Given a problem situation:
   a. Name the limitations, constants, and variables involved.
   b. Propose one way of performing an experiment to solve the problem.
4. Given the necessary equipment and supplies, conduct an experiment to determine which of three test vehicles exhibits the least friction on bearing surfaces.

Designing Manufactured Goods (Goals: 6, 12, 13, 14, 15)

1. Given a reading about designing manufactured goods:
   a. Discuss whether the appearance or the function of a new automobile is more important to you.
   b. List products which could be purchased without actually seeing the product through the package.
2. Given a presentation on product designing, identify the major steps necessary to begin a product design.
3. Given the problem of designing a Land Speed Record Assault Vehicle, select the limitations, constants, and variables which influence the design of the vehicle.

Creating Alternate Design Solutions (Goals: 12, 13, 14, 15)

1. Given information about creating alternate design solutions:
   a. List reasons why top management might reject a designer's rough sketches.
   b. Discuss what happens to alternate design solutions which are not used.

2. Given a demonstration of the process by which alternate design solutions are created:
    a. Name four design steps followed by industrial designers.
    b. Recall the common name for preliminary sketches.
    c. State why crude, free-hand sketches are valuable.
    d. State why it is desirable to keep many "thumbnails" and unfinished rough sketches.
    e. Name a device designers use to get an idea of the general shape and size of a design solution.
3. Given the problem of designing a Land Speed Record Assault Vehicle:
    a. Make several thumbnail sketches.
    b. Make rough sketches based on three of the thumbnails.
    c. Refine one rough sketch.
4. Given a demonstration of projection drawing, state the names of two views and indicate their relationship.

Making Three-Dimensional Models (Goals: 12, 13, 14, 15)

1. Given a reading about making three-dimensional models:
    a. List reasons why it would be important for the designer to have a mock-up of the interior of the Apollo Lunar Excursion Model (LEM).
    b. List some advantages and disadvantages which a product designer might obtain by showing a hard mock-up to future customers.
2. Given a drawing of a Land Speed Record Assault Vehicle:
    a. Name the steps involved in making a paste-up.
    b. Name four materials which can be used in making a mock-up.
    c. State why drawings are needed to make a paste-up and why paste-ups are made.
3. Given a full-scale drawing of a body design and necessary equipment and supplies:
    a. Make a template for each view.
    b. Transfer the pattern onto a foamed styrene block.
    c. Cut the block to shape, making a three-dimensional mock-up.
4. Given the terms "appearance mock-up" and "hard mock-up":
    a. State the difference between these types of mock-ups.
    b. State why hard mock-ups are made.
    c. Explain how hard mock-ups are different from the product they represent.

Refining the Design Solution (Goals: 12, 13, 14, 15)

1. Given information about refining design solutions:
    a. Name the types of people market research teams should interview before completing the design of a motorcycle.
    b. List a product and the reason you would have rejected it, if you had been asked about the product before it was manufactured.
2. Given a product, construct four questions that a custom builder would ask the buyer.

Engineering the Product (Goals: 6, 12, 13, 14, 15)

1. Given situations related to engineering the product:
    a. Explain why writers, illustrators, and editors are needed to help prepare service manuals.
    b. Discuss what your father could do if the motor of his electric razor burned out before and after the warranty period ended.
2. Given an activity concerning the fit of various size bearings on an axle rod:
    a. Attempt to fit each bearing on the axle.
    b. Measure the inside diameter of each bearing to the nearest 1/16".
    c. Measure the diameter of the axle to the nearest 1/16"
    d. Measure clearances.
    e. Record all measurements and analyze the data.

Designing Power Elements (Goals: 10, 12, 14, 15)

1. Given information related to the design of power elements:
    a. Discuss some of the safety features designed into your automobile to increase the safety factor.
    b. Discuss whether the electric-powered automobile will be more expensive to design and engineer than the present gasoline-powered automobile.
2. Given a problem concerning the thrust of a CO_2 powered LSRAV of different weights:
    a. Fire the LSRAV against a letter scale.
    b. Record and plot the findings and interpret the graph.
3. List several types of natural energy sources and explain how they are harnessed or transformed into usable energy.
4. Demonstrate or write how mechanical advantage is gained in each type of simple machine.

5. List several effects of the use of energy resources on the country and its people.
6. List or identify at least four types of reciprocating internal combustion engines.
7. Write or recite the basic principles of operation of the two- or four-stroke reciprocating engine.
8. Identify or recognize key parts of the reciprocating internal combustion engine. A list of the key parts includes: cylinder block and head, the combustion chamber, the cylinder, pistons and piston rings, the connecting rod, a camshaft on a four-cycle engine, a crankshaft, the carburetor, a four-cycle engine, and a two-cycle engine.
9. Write or recite at least two of the three engine accessory systems that we study, including being able to identify at least three major parts of these two systems.
10. Perform activities in the three previous objectives on reciprocating internal combustion engines.
11. Explain the concept of the rotary combustion engine using a transparent model of the engine as a guide.
12. Identify pictures of the rotor, the housing, the intake and exhaust port, and the end covers of the rotary combustion engine.
13. Recognize the operational differences between the turbojet engine, the turboprop engine, and the turbofan engine.
14. Write or recite the basic principles of operation of the gas turbine engine.
15. Identify the basic parts of the gas turbine engine: The compressor, the combustion chamber, the compressor turbine, the power turbine, the regenerator.
16. Demonstrate his ability to increase speed and decrease torque (or decrease speed and increase torque) by either changing the sizes of pulleys or chain sprockets, or by describing the action on paper.
17. Demonstrate his ability to increase speed and decrease power or decrease speed and increase power by changing the sizes of the gears on the input or output shaft by either writing it on paper or actually making the changes on a demonstration unit.
18. Assemble from laboratory equipment a small model of a lift machine operated by a fluid system.
19. Assemble from laboratory equipment a fluid-mechanical assembly that will automatically control the motion in a system.

Making Working Drawings (Goals: 6, 12)

1. Given an assembly drawing and a reading about making working drawings:

   a. Discuss how well your assembly drawing compares with the description of assembly drawings given in the text reading.
   b. List products in your home that are examples of a single piece of material, a series of assembled parts, and a system.
2. Given the presentation, explain the use of each type of working drawing in engineering a product.
3. Given the engineering requirements, begin drafting a set of working drawings for a model of the LSRAV.
4. Given the LSRAV drawings:
   a. Make detail drawings of the wheels, axles, bearings, and screw eyes.
   b. Prepare an assembly drawing by adding parts to the LSRAV body.
5. Given the working drawings:
   a. Enter dimensions and notes on all drawings.
   b. Prepare a parts list for all parts shown in the drawings.
6. Using the information provided, prepare a set of working drawings for the product.

Building the Production Prototype (Goal: 12)

1. Given information related to production prototypes:
   a. Discuss why management personnel or future consumers would want to examine prototypes of products before final designs are chosen.
   b. List reasons why the field testing of a prototype is the "greatest challenge that the prototype will meet."
2. Given the term production prototype, explain in their own words what a production prototype is and state two uses it may serve.
3. Given the necessary supplies and equipment, fabricate and assemble a production prototype according to a set of working drawings.

Technical Writing and Illustrating (Goal: 13)

1. Given a service manual and warranty for a household appliance:
   a. Determine if the instructions and illustrations in the service manual are easy for you to read and understand.
   b. Examine the warranty and list information from the warranty related to the household appliance.
2. Given the term "instruction manual," state how such a manual is useful to a consumer and name some examples of manuals found around the home.

3. Given an exploded pictorial view of the Land Speed Record Assault Vehicle and pertinent data, prepare an instruction manual containing a view of the LSRAV, specifications, and assembly and operating instructions.

Obtaining Approval of Management (Goal: 13)

1. Given a reading about obtaining the approval of management:
   a. Discuss how decisions would be made in a small company.
   b. Determine what information you would want to get from your product design staff before you decide on the product design for next year's automobiles.
2. Given a presentation:
   a. Name several departments that provide advise while a product is being designed.
   b. State how a company decides whether to release a design for production.
3. Given a product design, represent management or stockholders in a discussion of whether to accept or reject the design.

Planning Production (Goals: 10, 12, 13)

1. Given situations related to planning production:
   a. Give reasons why manufacturing companies cannot plan their production of products using the trial and error method.
   b. State why large manufacturing machines are built only to special order.
2. Given the supplies and equipment and a demonstration of processes, manufacture a salt shaker by hand processes. By so doing, begin building the production prototype.
3. Given the supplies and equipment, manufacture a pepper shaker using machines, jigs, and fixtures. By so doing, finish building the production prototype.
4. Given the term "operation sheet":
   a. Describe how the industrial engineer uses it to plan or improve production.
   b. Describe how and when operation sheets are prepared.
5. Given one of six processes to be used in manufacturing salt and pepper shakers, prepare an operation sheet for that process.

Tooling Up for Production (Goals: 10, 12, 13, 14, 16)

1. Given flowcharts, equipment, and supplies:
   a. Set up the production system for making the product parts.
   b. Conduct a trial run.
   c. Complete a Job Description Sheet.

2. Given information related to tooling up for production:
   a. Describe what would happen if the dimensions of a produced part do not match the dimensions of that part shown on the engineering drawing.
   b. List the tooling-up changes which would have to be made by a television manufacturer who desires to change the size of the television viewing screen.
3. Given a completed process flowchart:
   a. Check and adjust the production system setup for making salt and pepper shakers.
   b. Conduct a trial run.
   c. Complete a job description sheet.
4. Given a complete production system, manufacture one salt and pepper shaker set for each class member.

Planning Processes (Goals: 10, 12, 13, 14)

1. Given a reading about planning processes:
   a. Identify ways in which a worker on a production line can help his company lower production costs.
   b. Discuss what happens when new processes are discovered after a product has already been designed.
2. a. Given the term "product analysis", name the kinds of information obtained by a product analysis.
   b. Given the term "production flowchart", explain what it is.
3. Given the operation sheets for all the processes required to manufacture salt and pepper shakers, develop a production flowchart.

Designing and Engineering the Plant (Goals: 13, 14, 15)

1. Given situations related to designing and engineering the plant:
   a. Describe the kinds of transportation problems which must be solved by manufacturers of automobiles and dairy products.
   b. Explain why the availability of schools, homes, religious facilities, and recreation areas is important for a company to think about in choosing a good location.
2. Given information related to efficient plant design and engineering:
   a. Name six factors to consider in choosing the location of a manufacturing plant.
   b. Name four goals in designing a plant layout.

Supplying Equipment and Materials (Goals: 10, 13, 14)

1. Given a reading related to supplying equipment and materials:

   a. List ways management can use to decide on whether to purchase special or general purpose equipment.
   b. Describe what could happen if a purchasing department did not screen its vendors.
2. Given a list of items management has approved for purchasing, take part in bidding and purchasing activities between a purchasing department and several vendors.

Automating Processes (Goals: 10, 11, 12, 14, 15)

1. Given information related to automated processes:
   a. List some ways in which people can be helped when their jobs are replaced by automated equipment.
   b. Explain how automation has affected your life.
2. Given the presentation, explain automation and identify three examples of automated processes.
3. Given the materials and specifications, assemble and place a conveyor belt and unloading system appropriate for transporting salt and pepper shakers in production.

Installing Production Control Systems (Goals: 10, 12, 13, 14, 15)

1. Given a reading related to installing production control systems:
   a. List manufactured products which are processed by mass production, custom production, and intermittent production.
   b. List the kinds of materials you would find in the inventory of a bakery.
2. Given the production control findings from Problem 1, identify and agree upon needed corrective action.
3. Given a production system, monitor, record, evaluate, and propose some form of corrective action.
4. Given the experiences derived from Problem 1:
   a. Correct the production system.
   b. Continue to monitor, record, evaluate, and propose corrective action.

Processing Data or Information (Goals: 10, 11, 13)

1. Given situations related to processing data or information:
   a. Explain why data cards should not be bent, folded, stapled, or otherwise mutilated.
   b. Explain what happens to the people who originally did the job that is now being done by data processing.
2. Given the necessary equipment and supplies, record numerical and alphabetic data on a Port-A-Punch card.

3. Given a Port-A-Punch card and pencil, record their name and address.

Using the Computer (Goals: 10, 12, 13, 14)

1. Given information about using a computer:
    a. List what a computer can do, and determine if a computer can do more than man directs it to do.
    b. List three things that a computer did for you and your family.
2. Given two simple computer flowcharts, identify each one as being either a straight-line or a branching flowchart.
3. Given the four basic symbols, rectangle, diamond, trapezoid, and circle, identify their use on a flowchart.
4. Given the presentation, state how to solve a problem by a flowchart technique.
5. Given a branching flowchart and some input data, simulate the operation of a digital computer to solve a problem in addition.

Inputs to Manufacturing (Goal: 13)

1. Given information related to inputs to manufacturing:
    a. Describe how your life would change if the natural resources of wheat, petroleum, and trees were no longer available.
    b. Describe what would happen to manufacturing companies if all individuals took their savings out of the banks at one time.
2. Given a presentation:
    a. Name the six basic inputs to the manufacturing process and give an example of how energy is used in manufacturing.
    b. State where natural resources are found.
    c. Name two types of labor activities provided by human resources.
    d. Name three kinds of knowledge that are needed in manufacturing.
3. Given 20 pictures, correctly identify the major input to manufacturing that is represented in at least 16 of the 20 pictures.

Organization, Ownership, and Profit (Goals: 8, 9)

1. Given information about organization, ownership, and profit:
    a. Discuss how your life would change if the federal government removed all regulations of public utilities.
    b. Explain a plan of action for winning the game of Monopoly.
2. Given the textbook reading:
    a. Name three types of industrial organizations.
    b. Name one advantage and one disadvantage of each type.

3. Given a list of suggested names for a new corporation, vote for one.
4. Given a written script, play a role in the functioning of a new corporation.

Designing Manufactured Goods (Goals: 6, 11)

1. Given a demonstration on the design process, identify four steps followed to develop a product design, starting with a rough idea.
2. Given the problem of designing a selected product:
    a. Prepare rough sketches based on limitations and specifications.
    b. Develop a refined sketch from rough sketches and specifications.

Operating Quality Control Systems (Goals: 14, 15)

1. Given information related to operating quality-control systems:
    a. List products which would be tested by destructive and nondestructive testing.
    b. Discuss why it is not necessary to inspect every mass-produced product and what would happen if this was necessary.
2. Given a production situation, explain:
    a. Why product units coming off a production line are alike.
    b. The characteristics of interchangeable parts.
    c. The importance of quality control.
3. Given the problem of producing interchangeable parts for a product and the production planning experiences, develop needed gages and quality control devices for use on the production line.

Measuring Work (Goals: 2, 3, 4, 12)

1. Given situations related to measuring work:
    a. Determine the averabe time over a week it takes your family to wash dishes. Time the process every evening for a week from the moment the table is cleared until the last dish is put away.
    b. List reasons why labor unions and management disagree over work measurement processes and how these disagreements are settled.
2. Given a series of questions on work measurement:
    a. State how much work should be included in timing an operation.
    b. Describe how to use a watch for timing an operation or work activity.

3. Given the necessary equipment, supplies, and specifications, find the processing time for fabricating each component of a product.

Estimating Costs (Goals: 6, 14, 15, 16)

1. Given information related to estimating costs:
   a. Explain why estimators are especially important to shops that do contract work.
   b. List jobs in your community which have a low and high fatique allowance.
2. Given that estimating cost is important, identify two of the most important reasons.
3. Given that three kinds of direct cost are included in an estimate of manufacturing cost, name the three kinds of direct cost.
4. Given cost estimate charts and needed data, compute the total production cost of the product.

Manufacturing Production Technology (Goals: 12, 14, 15, 16)

1. Given a completed process flowchart and an assigned production activity, begin manufacturing of a required number of products.

Organized Labor and Collective Bargaining (Goals 2, 3, 4, 11, 13)

1. Given information about organized labor and collective bargaining:
   a. List reasons why strikes and long disputes happen between labor and management.
   b. Explain what is meant by collective bargaining, and list three factors that may be involved in bargaining.
2. Given a presentation on collective bargaining:
   a. Name two steps taken before striking in an attempt to solve a labor-management problem.
   b. Name four reasons for labor-management arbitration.
3. Given a collective bargaining situation, arrive at a solution by following the appropriate procedure.

Working, Advancing, and Retiring (Goals: 6, 11)

1. Given a reading about working, advancing, and retiring:
   a. Discuss why sweatshop conditions are no longer present in industry today.
   b. Explain why rest periods and coffee breaks make workers more effective on their jobs.
2. Given questions:
   a. State the original purpose of a work area in the manufacturing industry.

   b. Name some desirable working conditions in the manufacturing industry.

3. Given a labor-management problem, solve it through discussion between management and union representatives.

Harnessing Energy from Nature (Goals: 12, 14, 15)

1. Given information about the story of the telephone:
   a. Name the local telephone company and determine if it is an associated company of the Bell System or if it is an independent company.
   b. Describe some of the challenges that lie ahead for the telephone industry and describe the resulting changes.
2. Given diagrams of old-fashioned and modern telephone systems, determine the number of circuits required for each.
3. Given a 3/4" telephone harness, count the wires and record the color combinations.
4. Given six questions about the laboratory activities, answer five questions correctly.
5. Using a component or subassembly of a telephone, describe some of the processes involved in the manufacture of the component or subassembly.
6. Using a disassembled telephone, identify the components and subassemblies, and identify some of the materials used to make the components.
7. Place the voltmeter in the circuit correctly.
8. Produce electricity with friction.
9. Produce electricity with magnetism.
10. Generate electricity with heat.
11. Perform experiments using chemicals to produce an electrical current.
12. Produce heat with an electrical current.
13. Produce light energy from electrical energy.
14. Produce a chemical reaction using an electric current.
15. Trace the current path in a series circuit.
16. Trace the current path in a parallel circuit.
17. To test a transformer for shorts, continuity, and turns ratio.
18. Connect a transistor in a circuit to operate properly.
19. Assemble a duplicate of the fluid-mechanical system of Lesson 82 substituting electrical devices for all fluid devices.
20. Assemble from laboratory equipment an electric-motor-driven system that can be shifted in and out of operation by the use of fluid controls.

21. Given situations related to harnessing energy from nature:
    a. Explain how wind energy can be converted into electrical energy.
    b. Discuss the possibility of the United States generating too much electrical energy.
22. Given the term "energy":
    a. State s simple definition for it.
    b. List the six general classes of nature's energy.
    c. Give an example for each class.
23. Given one form of nature's energy, state a way for doing each of the following:
    a. Collecting it.
    b. Containing it.
    c. Controlling it.
24. Given the equipment and instructions, build a simple engine.

Securing and Extracting Raw Materials (Goal: 14)

1. Given a reading about securing reproducible raw materials:
    a. Explain why conservation is important in the harvesting of reproducible raw materials.
    b. Discuss the effects of air and water pollution on marine life.
    c. Determine if marine life will become a major source of human food as the world's population continues to grow.
2. Given the names of 10 raw materials, classify six as reproducible raw materials and the other four as nonreproducible raw materials.
3. Given a set of eleven illustrations, identify for each one:
    a. The practice shown.
    b. The raw material secured.
    c. The tools and equipment used.
    d. A product in which the material is used.
4. Given information related to the extracting of raw materials:
    a. List the mineral resources of your state.
    b. Discuss what might happen if man uses up the earth's supply of nonreproducible mineral resources.
5. Given the necessary equipment and supplies, demonstrate the conversion of fuel to heat energy, and of heat energy to mechanical energy, by operating a steam engine.

Manufacturing Production Technology (Goals: 6, 12, 13, 14, 15, 16)

1. Given information about manufacturing production technology:
   a. Explain how production practices add value to raw materials.
   b. List ways in which technology has made work in your home easier to do.
2. Given pictures illustrating the five main production stages in making a newspaper, name practices that students think might be used at each stage.
3. Given a series of questions:
   a. Explain how two refining techniques, washing and cleaning, are used to free sand, gravel, ore, meat, vegetables, and fruit from unwanted materials.
   b. Explain how raw materials such as coal, gravel, eggs, and potatoes are separated by screening and sizing.
   c. Name some of the six processes used to remove coverings from fish, meat, fruit, etc.
   d. Name the four practices of bulding: measuring, weighing, collecting, and unitizing.
4. Given the term "converting", list three examples of changing refined raw materials into industrial materials.
5. Given a list of descriptions and a list of terms:
   a. Identify descriptions of refining and of bulking.
   b. Select five terms that name refining techniques.
6. Given a mixture of sand and aggregate, and the necessary equipment and supplies, screen-sort the mixture by size, measure, and record the results.
7. Given a mixture of iron filings and sand, and the necessary equipment and supplies, separate the iron from the sand magnetically.
8. Given information about making industrial materials into standard stock:
   a. Explain what would have to be done in order to build a bench without standard stock.
   b. Identify the kinds of standard stock which were used to manufacture your shoes, shirt, and kitchen chairs.
9. Given a list of ten items, identify which five are standard-stock items and which five are standard-parts items.
10. Given the equipment and supplies, manufacture a sheet of standard-stock paper by performing mixing, screening, sizing, drying, and trimming operations.
11. Given information about making components by forming or separating:
    a. Identify two one-piece products around your home that have been manufactured by forming or separating.

   b. Select any assembled product in your house where most of the parts can be seen, and count the number of parts in the product.

12. Using a filmstrip presentation, identify:
    a. Raw materials.
    b. Standard stock.
    c. Components.
    d. Subassemblies.
    e. Assemblies.
    f. Finished products.

13. Given twenty illustrations of manufacturing processes, identify the stage of production represented in each picture.

Material Forming Practices (Goals: 6, 12, 14, 15)

1. Using information about material forming processes:
   a. Identify a product or part of a product that has been formed by:
      (1) Casting or molding.
      (2) Compressing or stretching
      (3) By material conditioning.
   b. Identify products around the home that have been made by:
      (1) Forming.
      (2) Bending.
      (3) Drawing.
2. Using a filmstrip presentation:
   a. Explain forming.
   b. Describe the three major ways of forming.
   c. Describe casting or molding.

Casting or Molding (Goals: 12, 14, 15)

1. Given information about casting or molding:
   a. Identify three products in the home that have been made by casting or molding.
   b. Identify which of these products have been done by one-shot casting and permanent-mold casting processes.
2. Given a permanent mold and the ingredients for sand-mix cement, cast two to four concrete bricks per group to demonstrate a permanent-mold casting process.

3. Using a filmstrip on casting or molding processes:
   a. Describe the casting or molding process.
   b. Describe the differences between one-shot and permanent molding processes.
   c. Name the major one-shot molding processes and give examples of products produced by one-shot molds.
   d. Name the major permanent molding processes and give examples of products produced by permanent molds.
   e. Describe two ways that a mold may be designed to permit removing the molded part and give examples of products produced by open and upset molds.
4. Given a discussion and a demonstration covering casting or molding, and questions on the major concepts involved, demonstrate knowledge of the materials covered by successfully answering eighty per cent of the questions in the laboratory manual.

Conditioning Material (Goals: 12, 14, 15)

1. Using information about conditioning material:
   a. Identify products around the home that have been conditioned by heat treating, mechanical deformation, and by chemical reaction.
   b. Identify what kinds of chemical reactions go on in the baking of bread dough and in the canning of fruits and vegetables.
2. Using a filmstrip presentation:
   a. Define conditioning.
   b. Give two reasons for conditioning a material.
   c. Name three major conditioning processes.
3. Using the term thermal conditioning, name an example.
4. Using the example of a hard-boiled egg, identify the kind of conditioning process it has undergone.
5. Using an example of a metal bowl formed by spinning, identify the kind of conditioning process which occurs during the spinning operation.
6. Using a suitable mold and a mixture of casting resin and hardener, pour the mixture into the mold to form a screwdriver handle.
7. Given a presentation-demonstration on thermal conditioning, explain or describe:
   a. Why the screwdriver blade needs conditioning.
   b. The procedure for conditioning the screwdriver blade.
   c. The effect of quenching and hardening by metal deformation.
8. Given a demonstration and the necessary equipment and supplies, thermal-condition a screwdriver blade by heat treating and quenching.

Compressing or Stretching (Goals: 12, 14, 15)

1. Using the information about compressing and stretching processes:
    a. Identify products around the home that have been formed by compressing and stretching.
    b. State how makers of cookies (or spaghetti) use compressing or stretching processes in the manufacture of these products.
2. Given a presentation on compressing and stretching:
    a. Name the major categories of compressing or stretching processes.
    b. Name the forces involved in forging, rolling, and compression molding.
    c. Name a forming process in which both stretching and compressing occur.
    d. Name the forces which occur in such drawing processes as vacuum forming and stretch forming.
    e. Give examples of forming by forging, rolling, compression molding, bending, and drawing.
3. Given a demonstration on vacuum forming and compression molding:
    a. Vacuum-form an object as shown in laboratory manual.
    b. Perform an operation of compressing some material in a mold under the pressure of a vise.

Material Separating Practices (Goals: 12, 14, 15)

1. Given information about material separating processes:
    a. Determine which separating process should be used to separate: sheet metal, sheet rubber, an iron casting, paper, and a block of stone.
    b. Determine which separating practice would be used to: cut glass for a window pane, burn a hole through metal, etch a design on glass or metal, cut a rough diamond, and rapidly eat a hole through metal.
2. Using the necessary equipment and supplies, successfully make a metal I.D. tag.
3. Given five operations performed in this activity, identify the practices that each represents.
4. Given information on separating by other processes:
    a. Explain how advances in nontraditional processes of separating have helped in miniaturization.
    b. Explain the differences between thermal erosion, chemical separating, electrochemical separating, and induced-fracture separating.

5. Using a filmstrip presentation, demonstration, and examples of processes, classify each example as thermal erosion, chemical separating, electrochemical separating, or induced-fracture separating.
6. Given a demonstration on how to separate glass by induced fracture, state how to separate glass plate and circular glass (such as a bottle) by induced fracture.
7. Given a demonstration on chemical separating, etch a design on plate glass.
8. Using the appropriate equipment and supplies, cut and etch glass.

Shearing (Goals: 12, 14, 15)

1. Using information on shearing processes:
    a. Explain the difference between shearing and chip removing.
    b. Identify the steps standard stock textiles must go through to become a shirt and identify the steps in which shearing is done.
2. Given a filmstrip presentation on shearing:
    a. State the two basic purposes for shearing.
    b. State three factors necessary for shearing.
    c. list five shearing operations.
    d. state the main advantage of shearing.
3. Using a die cutter and the necessary equipment and supplies, shear vinyl to a predetermined size.
4. Given a presentation on shearing:
    a. Name five examples of materials that can be sheared to shape.
    b. State the advantage of die cutting.
    c. Name five examples of die-cut components.
5. Using the necessary equipment and supplies, shear a paper stencil.

Chip Removing (Goals: 12, 14, 15)

1. Given information about the processes of chip removing:
    a. Name some of the single-edge and multiple-edge tools found around the home.
    b. Give reasons why it is more economical to use chip removing processes for making a small number of parts, rather than a large number of parts.
2. Given a demonstration on laying out a half-pattern:
    a. State the procedure used to lay out a pattern for a house-marker panel.

    b. State the procedure used to lay out and shear a contact stencil for the house marker.

3. Given a filmstrip presentation, name several chip removing processes.
4. Given the necessary equipment and supplies:
    a. Perform sawing, sanding, drilling, and filing operations to produce a contact vinyl house-number stencil.
5. Use the proper equipment and supplies to produce the housemarker components by performing the operations of:
    a. Sawing.
    b. Sanding.
    c. Drilling.
    d. Filing.
    e. Shearing.

Combining Components (Goals: 12, 14, 15)

1. Given information on combining components:
    a. List the ingredients that were mixed together to produce foods in a liquid form, solid form, and powdered form.
    b. Look at a product in the home (a bed, for example) and identify which parts were coated, bonded, and mechanically fastened.
2. Given a presentation and examples, describe in their own words the changes that occur during some mixing, coating, and bonding of materials.
3. Using the manufactured components that require adhesive bonding and coating, coat and bond the components to produce the finished housemarker product.
4. Given questions on coating:
    a. Describe coating.
    b. Name five reasons for coating material.
    c. Tell how coating is related to bonding.
    d. Name ten examples of coating materials and processes.
5. Using the necessary equipment and supplies:
    a. Coat a component by screen-stencil printing.
    b. Coat a component by spray-stencil printing.

Bonding (Goals: 12, 14, 15)

1. Using information on bonding:
    a. Identify kinds of products in the home that were fusion-bonded in assembling them at the factory.

   b. Identify kinds of products in the home that were adhesive-bonded before you got them and after you got them.

2. Using the necessary equipment and supplies, cut off and properly lay out the stem for a mallet handle.

3. Given questions about bonding processes and examples, state the class of bonding represented by the four examples.

4. Using the necessary materials and supplies, fabricate and combine the components to complete a handle acceptable for mounting a soft-faced mallet.

Coating (Goals: 12, 14, 15)

1. Given information on coating:
   a. Name some products other than fire extinguishers and school buses having coatings that transmit information.
   b. Look at a store display and name products that have been coated for eye appeal, and for protection.
2. Given questions about coating materials:
   a. Describe applied coating and conversion coating.
   b. Name six applied-coating practices.
   c. Name one conversion-coating practice.
   d. Name three classifications of coating materials.
3. Using component, hammer handle:
   a. Spray-coat one-half of the handle with spray enamel.
   b. Dip corded portion of the handle to coat and bond the grip.

Mechanical Fastening (Goals: 12, 14, 15)

1. Given information about mechanical fastening:
   a. Look at a toaster, mixer, blender, or some other small appliance, and name the kinds of fasteners used in one of the products.
   b. Name three products in the home that have been fastened by: nails and staples, threaded devices, and lacing.
2. Given five questions:
   a. Name two basic classes of mechanical fasteners.
   b. Name the force which mechanical fasteners use to hold components together.
   c. Explain how components can be mechanically fastened together without using separate fasteners.
   d. Name two ways in which the coarseness or fineness of threads affects usage.

3. Using the necessary equipment and supplies, fabricate and combine components to make a soft-faced mallet by using threaded and nonthreaded fasteners to assemble the components.

Mixing (Goals: 12, 14, 15)

1. Given information on mixing:
   a. Give some examples of the mixing of two solids, and the mixing of two liquids that take place in the home.
   b. Give some examples of the mixing of solid with a liquid, and the mixing of a gas and a liquid that take place in the home.
2. Given questions, state some examples of products that are manufactured by mixing and state the mixing technique used to manufacture each example.
3. Using the necessary equipment and supplies, manufacture an expanded foam sponge to simulate industrial practices of mixing and forming by conditioning materials.

Combining Subassemblies (Goals: 12, 15)

1. Using information about combining subassemblies:
   a. Identify products in the home or school that were made by batch and by continuous assembly.
   b. Give reasons why women can do some assembly jobs better than men.
2. Given a presentation on combining subassemblies:
   a. State how components are formed into subassemblies.
   b. Name the two major types of assembly.
   c. Name four examples of products assembled by batch or lot assembly.
   d. Name four examples of products assembled by continuous or line assembly.
3. Using a drawing of a specific product:
   a. Analyze the product and determine the components to be manufactured and the possible materials and processes necessary for its manufacture.
   b. Complete a route sheet for a single component.
4. Using the term "subassembly", describe five examples of subassemblies.
5. Given a demonstration, subassemblies, and necessary tools, combine subassemblies to make two runs of five socket, wire, and plug assemblies.
6. Given the time and workmanship of two production runs, determine if production time was lowered without loss of quality.

Making Assemblies or Finished Products (Goals: 6, 12, 15)

1. Using information on making assemblies or finished products:
    a. Name some of the products around the home and identify which parts were assemblies in one stage of their manufacture but subassemblies in others.
    b. Name products in the classroom that have been combined by mixing, coating, bonding, and mechanical fastening.
2. Using the school laboratory and its contents, identify those manufactured products which were produced by combining processes.
3. Using a filmstrip presentation, name four basic classifications of combining processes.
4. Using an example of a racing car, identify four parts and groups of parts as components, subassemblies, or a final assembly.
5. Given a screwdriver handle, a screwdriver blade, and epoxy glue, perform sawing, filing, drilling, mixing, coating, and bonding operations to combine the three components to produce a final assembly or finished product.

Preparing for Distribution (Goals: 6, 12, 14, 15)

1. Given information about preparing for distribution:
    a. Select a product from the kitchen with an attractive package, describe why this package is more attractive than others, and briefly describe the making of this package from raw material to finished product.
    b. Select a product you used today which went through the most complex distribution stage of manufacturing and describe the distribution steps of that product.
2. Given packages for manufactured products, analyze and describe how the packages protect, label, and aid handling and storing of products.
3. Given two typical packages for manufactured products and specific criteria, analyze how the packages protect, label, and aid handling and storing.

Servicing Manufactured Products (Goals: 6, 12, 14, 15, 16)

1. Given information on servicing manufactured products:
    a. Visit a neighborhood hardware store and identify five products that need servicing before they can be used and five products that need no servicing before they are used.
    b. Look at the advertisements in a magazine or newspaper and list five durable products and five nondurable products.
2. Given nine service occupations, select whether the service is performed at home or in a shop.
3. Using a crossword puzzle, complete the puzzle by identifying twenty durable and fifteen nondurable goods.

4. Using a word puzzle containing names of servicing occupations, locate and identify 25 out of 27 occupations.
5. Given a presentation on servicing:
   a. Name the term that identifies the process of locating a malfunction.
   b. Explain in one sentence how a malfunction is identified.
   c. Given the example of a flat tire on a motorbike, diagnose the procedure for repair.
6. Given the malfunctioning system and the necessary equipment and supplies, diagnose and locate the malfunction.

The Manufacturing Corporation (Goals: 8, 9, 10)

1. Given information about the manufacturing corporation:
   a. Look in the yellow pages of the local phone book and find five corporations and explain how you know they are corporations.
   b. To sell a new service, describe how to go about finding the names of the five largest corporations.
2. Given a presentation and questions, state at least three advantages and at least two disadvantages of a corporation.
3. Given the appropriate laboratory manual figures and a set of slides:
   a. Identify some advantages and disadvantages of corporations.
   b. Name three corporations and identify their trademarks.

Forming a Corporation (Goals: 8, 9, 10)

1. Given information about forming a corporation:
   a. Identify where in the community one would go to find the rules and regulations that control corporations in your state.
   b. List three major manufacturing corporations that have their legal residence in your state and tell how this information can be found.
2. Using the filmstrip presentation as a reference:
   a. Name three basic steps in forming a corporation.
   b. Name three probable advantages of a corporation in manufacturing of products.
3. Given requirements for forming a corporation, select a corporate name.
4. Given a presentation on incorporating a company, name three basic steps in applying for a charter.

5. Given requirements for forming a corporation:
   a. Elect three students to the board of incorporators.
   b. Name the corporation.
   c. Select an agent.
   d. Fill out the forms to obtain a charter.
   e. Design a trademark.

Locating the Plant and Securing Inputs (Goals: 8, 9, 12)

1. Given information on locating the plant and securing inputs:
   a. Name three specific examples of inputs of each of the following: natural resources, energy, and human resources.
   b. Name some inputs the community may not have that manufacturers would need in order to locate in the area.
2. Given the problem of establishing and financing a corporation, name the most common way management obtains capital.
3. Given the problem of securing capital to begin a corporation, issue the necessary number of stocks.
4. Sell stocks and complete stock certificate.

Relating People to the Corporation (Goals: 6, 8, 9, 11, 13, 16)

1. Given information about relating people to the corporation:
   a. List three advantages of being a production worker, and list three advantages of being a manager.
   b. Look at the want ads in the local newspaper and determine if there are more job openings for managers or for production workers, and explain why this is true.
2. Using the text reading and presentation, explain:
   a. The role of stockholders, directors, and a corporation president.
   b. The difference between wages and salaries.
3. Given the task of structuring a corporation:
   a. Fill in an organization chart (chair of command) according to the names of students selected for each job.
   b. Fill out an employment application at the time students are selected for jobs.
   c. Compute accurately one week's payroll for the corporation.
4. Using a set of six photographs, classify those which represent management and those which represent production, and classify the production activities, as skilled, semiskilled, and unskilled.

Designing and Engineering the Product (Goals: 6, 10, 12, 13)

1. Given information about designing and engineering the product:
    a. Look through today's newspaper and pick out the product you think was the hardest or easiest to design and engineer.
    b. Briefly explain why you picked the products as being the hardest or easiest to design and engineer.
2. Given the process of designing a desk lamp:
    a. List the first and last steps.
    b. Explain the need for a soft mock-up.
3. Given patterns of the lamp components, cut out and assemble the components to make an appearance mock-up of the lamp.
4. Given a description and use of three kinds of drawings, and a prototype, identify the description of an assembly, detail, or exploded drawing.
5. Given an exploded drawing with all parts numbered, and a partially completed parts list, fill in proper description of remaining parts.
6. Given an incomplete three-view drawing of a lamp, fill in the object lines, and supply the dimensions necessary to complete the working drawing.
7. Given a pictorial electrical drawing and electrical symbols, sketch an electrical schematic.
8. Given the patterns, templates, sheet metal, or tubing and the necessary tools, make five each of three lamp components for the prototype.
9. Given the six lamp components and other locally-purchased components, combine them to produce five complete prototypes.

Making the Sales Forecast (Goal: 10, 15)

1. Given information about making a sales forecast:
    a. Identify what kinds of data a breakfast cereal manufacturer must get before he decides to manufacture and market the product at a given price.
    b. Name a product now on the market that was not heard of five years ago and suggest why this product was developed.
2. Given a presentation and questions, state purposes of a consumer survey and a sales forecast.
3. Given a consumer situation, complete items on a survey form.
4. Given the results of a consumer survey, complete seven items of information from the survey forms and make a sales forecast.

Obtaining Capital, Estimating Profits, and Keeping Records (Goals: 9, 10, 15)

1. Given information about obtaining capital, estimating profits, and keeping records:
   a. Explain where one would look to find the names of lending organizations in your community, and list some that you find that lend money for starting a corporation.
   b. Look in the financial (business) section of the local newspaper and list three corporations that are trying to raise money through the sale of bonds and list three that are trying to raise money through the sale of stock.
2. Given the concept "break-even":
   a. Explain what it means.
   b. Explain how a break-even chart is used.
3. Given the concept "balance sheet":
   a. State some kinds of information that may appear on a balance sheet.
   b. Explain the difference between assets and liabilities.
4. Given cost and production figures, study how a break-even chart was arrived at and profits were estimated.
5. Given a balance sheet, study how the financial conditions of a company can be determined.

Planning Production Processes (Goals: 10, 12, 13, 14, 15)

1. Given information on planning production processes:
   a. Look at a pencil or pen and list the processes used in the manufacture of that product.
   b. Write a schedule for the activities (processes) you did this morning in getting dressed and ready to go to school. Study the schedule and see where changes can be made to increase the efficiency of the processes. Follow the new schedule tomorrow and compare the efficiency.
2. Given a presentation on planning production processes:
   a. Supply the name for a chart that describes the sequence of production processes.
   b. Name the steps in making a route sheet from infromation on a process flowchart.
   c. Name three kinds of information needed on an operation sheet.
3. Given the proper forms and the directions:
   a. Complete a production center flowchart.
   b. Complete a process flowchart.

  c. Complete a route sheet and list processes.
  d. Select the main step in the sequence of the operations in the lamp base drilling operation sheet.

Establishing Production and Quality Control (Goals: 10, 12, 14, 15)

1. Given information on establishing production and quality control:
    a. Describe what differences there are in the quality control of a $.10 pen as compared to a $3.00 pen.
    b. Name some of the production control problems that a large clothing manufacturer might have.
2. Given a presentation-demonstration and a transparency:
    a. Name three controls needed in production control.
    b. State the purpose of inventory control.
    c. Name two means of providing quality control.
3. Given components, gages, and inspection templates:
    a. Inspect two flat base-bottoms and two shade-top components and, by using an inspection template, distinguish between the reject and the acceptable components.
    b. Inspect two formed base-bottoms and two formed shade-top components and, by using a go-no-go gage, detect the reject and the acceptable components.
4. Given a presentation-demonstration:
    a. Name three things that can be done to control production.
    b. Name two examples of interchangeability of parts in lamp production.
    c. Name the practice that controls the quality of our lamp.
5. Given the necessary reassignment to jobs, continue production of the lamp.

Making and Combining Components and Subassemblies (Goals: 12, 14, 15)

1. Given information about making and combining components:
    a. Look at a table lamp and identify what separating, forming, and assembling processes were used on the shade, top, body, and electrical circuit.
    b. Name some of the problems the manufacturer of a supersonic commercial passenger airplane must solve in assembling the different parts and subassemblies.
2. Given the necessary equipment and supplies, make enough components so that when they are combined there will be a completed lamp for each student in the corporation.
3. Given the necessary tools, manufactured and purchased components, combine them so each student in the corporation receives a complete and tested lamp.

Liquidating the Corporation (Goals: 8, 9, 15)

1. Given information on liquidating the corporation:
   a. Look in the local newspaper for corporations that are going out of business and give the reasons why they are going out of business.
   b. Describe how corporations in the community are helping to fight air and water pollution.
2. Given a balance sheet, state one difference between the balance sheets of liquidated and nonliquidated corporations.
3. Given the corporate worth and the number of stockholders of a corporation, calculate a final dividend for each stockholder.
4. Given the necessary corporate records, balance the lamp corporation books and disolve the corporation.

Arranging for Distribution and Sales (Goals: 10, 13, 15)

1. Given information about arranging for distribution and sales:
   a. Look at a package and describe how it contains, identifies, protects, and displays the product.
   b. List as many places as you can think of in which you would advertise your desk lamp to reach as many teenagers as possible.
2. Given a presentation on arranging for product sales and distribution, and questions:
   a. Name at least three kinds of servicing information.
   b. Name at least five purposes of packaging.
   c. Name five out of eight types of advertising media.
3. Given a lesson on product sales and distribution, fabricate a package that will protect, identify, display, and store individual high-intensity desk lamps. Produce and insert into the package a service manual for the lamp.

Manufacturing in the Future (Goals: 6, 8, 9, 16)

1. Given information about manufacturing in the future:
   a. Describe how manufacturers of the future will use materials over again and tell how this will affect the pollution problems we are facing now.
   b. Identify jobs in the community that are changing as a result of technological progress.
2. Given an illustrated presentation-discussion, the students will volunteer to discuss their ideas for school courses that would best prepare them to understand manufacturing in the future.

3. Given an illustrated presentation, each student will list five suggestions for new manufactured products and be prepared to discuss his ideas with the class.

4. Given a display of products manufactured in class, each student will be prepared to suggest improvement in our product designs during class discussion.

PERFORMANCE INDICATORS
(Eighth Grade)

As a result of their learning experiences, the students should be able to do the following:

Introduction (Goals: All)

1. Given the course organization and content:
   a. Name some of the student activities in the course.
   b. Name the books they will use in the course and explain how, when, and where each is to be used.
   c. Define the term "concept" and state how concepts will be studied in this class.
   d. State what the homework assignment is, and how and when it should be done.

Construction Technology (Goals: 8, 9, 10, 11, 17)

1. Given information related to construction technology:
   a. Name the three main functions of management technology.
   b. Name the five main functions of personnel technology.
   c. Name the three main functions of production technology.
2. Given a lecture and reading:
   a. State why construction is a managed production system.
   b. Define technology.
   c. Name some examples of management, personnel, and production practices.

Man and Technology (Goals: 1, 3, 4, 6, 12, 13)

1. Given information related to man and technology:
   a. Describe how specialized tools and technology lead to the development of an economic system.
   b. Name three examples of materials which are:
      (1) Extracted.
      (2) Reproduced.
      (3) Constructed.
      (4) Manufactured.
   c. Explain the difference between a constructed product and a manufactured product and give three examples of each.
2. Given a reading and a lecture on man and technology:
   a. Identify industry as one part of economic technology.

b. State why people specialize in their work.

c. State what effect technology and specialization have upon our standard of living.

3. Given a piece of wood, an electric drill, a hand drill, and a bow drill, drill holes correctly and compare efficiency.

4. Given time and cost charts, record, examine, and compare efficiency in relation to time and cost per hole.

Applying Technology to People (Goals: All)

1. Given structures related to personnel technology:

   a. Compare a coffee break on a job with a recess at school and tell why people always work harder or better after a break.

   b. Suggest two or three ways to handle each of these personnel problems.

      (1) A construction worker does not like to wear his safety helmet.

      (2) A worker who is very friendly wastes time talking.

      (3) A man who works very hard thinks he is not paid enough because other workers get the same wages and do less work.

2. Given a series of questions, identify who hires contractors, architects, engineers, tradesmen, supervisors, and foremen and identify how they may be trained, assigned to jobs, advanced, and retired.

3. Given the laboratory manual and instructions by the instructor, apply the management technology of organizing to people and things by:

   a. Structuring the class into groups, each consisting of a foreman, timekeeper, recorder, safety and grievance man, and equipment supervisor, for efficient classroom operation.

   b. Coding the laboratory manuals for easy organization, identification, distribution, and collection.

Managing Construction (Goals: 6, 9, 10, 11)

1. Given instructions related to managing technology:

   a. Describe what planning, organizing, and controlling tasks each of these committees would have for a class party.

      (1) Food committee.

      (2) Decorating committee.

      (3) Entertainment committee.

   b. Name some of your activities that fit into the categories of:

(1) Retrieving (What was?).

(2) Describing (What is?).

(3) Experimenting (What will be?).

2. Given the word game "Build," answer questions about the concepts used in the game.

3. Given a list of management activities, classify and give examples of each one as belonging to the planning function, the organizing function, or the controlling function of management.

Beginning the Project (Goals: 6, 8, 9)

1. Given situations related to beginning a project:
   a. Give reasons for spending public funds to build a recreation center for teenage boys and girls.
   b. Name who might provide the money, and why the project is planned as a private project.
   c. Name some things you would have to know about to determine if a recreation center is feasible.
2. Given a lecture and reading:
   a. Define the terms "feasibility" and "feasibility study."
   b. Define the term "initiator".
3. Given local newspaper clippings, identify local community problems and recommended solutions.
4. Given a list of community problems and possible solutions and acting as professional consultants, identify some basic problems that exist in their community and recommend a solution.
5. Given five major community problems and recommended solutions and acting as a city planning commission, select a project to be supported and develop the publicity for the project.

Selecting a Site (Goals: 6, 8, 9)

1. Given situations related to selecting a site:
   a. Name some general needs that people must keep in mind in deciding where to build a:
      (1) New airport.
      (2) Shopping center.
      (3) Factory.
   b. Name several things that you and the seller must agree about before you would buy his auto repair.
   c. Describe how negotiations would be affected if you only want to buy the garage site and have no need for the garage building or equipment.

2. Given a reading and a lecture:
   a. Define "site".
   b. Name three of the important factors in selecting a site, and explain why or how they are important.
3. Given an illustration of potential construction sites in a community, a selected project to build, and a table of site feasibility factors:
   a. Identify the available sites on the illustration.
   b. Determine the feasibility of each site as a potential construction site.
   c. Select a site for the project.

Buying Real Estate (Goals: 8, 17)

1. Given situations related to buying real estate:
   a. Explain each of the following terms by using examples.
      (1) Boundaries.
      (2) Improvements.
      (3) Natural features.
      (4) Easements.
      (5) Encroachments.
   b. Name the kinds of information recorded on a dead for a building.
2. Given the lecture:
   a. Explain why accurate measurement is essential in surveying.
   b. Explain why it is necessary to scale down dimensions.
3. Given a legal description of a lot, use a mock surveying device to lay out a scaled-down model lot.

Surveying and Mapping (Goals: 8, 10, 16, 17)

1. Given information related to surveying and mapping:
   a. State why a surveyor begins his measuring from a monument or bench mark.
   b. List the natural features that may have existed, on and near the site of your school, before the land was settled and developed.
   c. Name what improvements would be shown on a topographic map of your school grounds.
2. Given a site box with sand, a level bar, and a stadia rod:
   a. Measure elevation with a stadia rod.
   b. Record elevation data on a grid sheet.

   c. Draw contour lines by connecting all recorded elevations of the same height.

3. Given a topographic may showing a proposed highway route and two profile charts, plot the profile of the land surface along the length of the highway route and along a cross section.

Soil Testing (Goals: 8, 13, 16)

1. Given information related to soil testing:
   a. Describe how the soil in your community may affect the following:
      (1) Water supply.
      (2) Building foundations.
      (3) Basements.
      (4) Roadways.
      (5) Drainage.
      (6) Plant growth.
2. Given measuring devices, containers, and soil samples:
   a. Analyze two soil samples, clay and sand, to find out if excavation facing is needed.
   b. Test two soils, clay and sand, for water absorption.
   c. Analyze the soil strengths of clay and sand.

Designing and Engineering Construction Projects (Goals: 6, 8, 9, 10, 11, 16)

1. Given the design procedures for a neighborhood playground:
   a. Describe what needs to be done to:
      (1) Identify the problem.
      (2) Develop preliminary ideas.
      (3) Define these ideas.
      (4) Analyze the design.
      (5) Select the final design.
      (6) Get the playground built (implement the design).
2. Given a series of pictures of construction projects, identify the function of each project and the need for each one.
3. Given a series of pictures of construction projects, suggest at least two problems relating to the design of each project.
4. Given six design steps, together with illustrations and descriptions of several construction projects, match the design step with the illustration.
5. Given illustrations and descriptions of construction projects, indicate for each project whether the chief designer probably was an architect, an engineer, or an architect and an engineer.

Identifying the Design Problem (Goals: 6, 8, 9, 10, 11, 16)

1. Given situations related to identifying design problems:
   a. Describe the general needs that these structures fill.
      (1) Warehouse.
      (2) Garage.
      (3) School.
      (4) Hospital.
      (5) Factory.
      (6) Department store.
   b. Describe what kinds of data should be gathered to plan how to move people from floor to floor in a new three-story hospital.
   c. Evaluate your answers to the above and tell how they will affect the building design.
2. Given the problem of designing boating facilities at a community boating area, identify the major element of the problem.
3. Given the problem and the major elements of the problem, identify several kinds of data required to complete the problem identification.
4. Given the problem and several kinds of data, evaluate the effect of the data on the design problem.
5. Given the problem of designing a community park, identify the major needs that the park should meet.
6. Given the major needs for a park, list several kinds of data that will help identify the needs.
7. Given the needs and related data, evaluate the data and determine the effect on the design problem.

Developing Preliminary Ideas (Goals: 6, 8, 9, 10, 11, 16)

1. Given situations related to developing preliminary ideas:
   a. Give reasons why a designer should sketch and write his preliminary ideas before he works out exact dimensions.
   b. Describe your "brainstorming" ideas about one of the following structures.
      (1) A house that can be cleaned inside and out using hot water from a garden hose.
      (2) A combination garage and storage area that can be kept free of animals, insects, and excess dampness.
2. Given the term "preliminary idea," identify its use in solving a design problem.

3. Given the term "preliminary ideas", identify the techniques used to record preliminary ideas for solving a design problem.
4. Given the problem of designing a community park, develop preliminary ideas for park areas and structures.
5. Given the problem of designing a community park, develop preliminary ideas for one of the areas or one of the structures.

Refining Ideas (Goals: 6, 8, 9, 10, 11, 16)

1. Given situations related to refining ideas:
    a. Explain what dimensions and activities need to be studied to design a classroom for music activities.
    b. List some things that could go wrong if a designer did not carefully work out the music room sizes and dimensions.
2. Given a demonstration on scaling a parking area, define the terms: proportion and scale.
3. Given the proportions for the park areas and structures:
    a. Draw a refined sketch of the location of areas and structures.
    b. Plan the walkways to connect the areas.

Analyzing the Design (Goals: 6, 9, 11, 16)

1. Given a situation related to engineering a design for a neighbor hood playground:
    a. Name what special structural problems should be considered.
    b. Name what functional problems need study before equipment is installed.
    c. Name what site problems need study before equipment is installed.
2. Given a lecture-demonstration on determining the counterbalance weight for a bascule bridge, identify the data needed to solve the problem.
3. Given the span dimensions of a bascule bridge and the location of the bridge's pivot point:
    a. Compute the weight needed to counterbalance a vehicle load on the bridge.
    b. Test the computation by constructing and counterbalancing a simple bascule bridge.
4. Given a lecture-demonstration about determining a grade limit for a roadway, identify the data needed to solve the problem.
5. Given the weight of vehicle in tons and the pounds of engine pull:

   a. Compute the grade limit for roadways made of concrete or blacktop, gravel, and sand.
   b. Test the computation by constructing and testing a simple road grade.

Selecting the Design (Goals: 8, 9)

1. Given situations related to selecting a design for a neighborhood park:
   a. Write some questions that a committee of businessmen, parents, teachers, and city officials might ask before they decide on a plan.
   b. State how you might use each of the following devices to help answer the committee's questions.
      (1) Models.
      (2) Photographs of similar projects.
      (3) Bar graphs and tables of figures.
      (4) Diagrams that show function or movement.
2. Given the design requirements and construction specifications for a bascule bridge:
   a. Act as a design selection committee.
   b. Select the best bascule bridge design for the community park and present the selection to the class.
3. Given the design requirements and construction specifications for a roadway:
   a. Act as a design selection committee.
   b. Select the best roadway design for the community park and present the selection to the class.

Making Working Drawings (Goals: 6, 8, 9, 11, 16)

1. Given information related to making working drawings for a neighborhood playground:
   a. Name the types of working drawings needed to explain the layout and construction details.
2. Given a series of questions:
   a. State two reasons why working drawings must be dimensioned as well as drawn to scale.
   b. Explain why dimensions of separate drawings must be checked against one another.
3. Given a set of contract working drawings, read the drawings and identify the following:
   a. The location of the house.

   b. The overall length and width of the house and garage.
   c. The scale of the left, right, and rear elevations.
   d. The depth of the concrete block foundation wall.
   e. The roof, detail and heating plans.

4. Given the term "side plan," identify what it is and why it is important.
5. Given the site contour lines, explain their relationship to the structure.
6. Given the local building code, explain its relationship to the placement of the structure on the lot.
7. Given the contour map of a building site, locate, lay out, and sketch a structure to scale on a site plan, including compass orientation, driveway placement, and dimensioning.
8. Given the design requirements for a garage, draw the foundation plan to scale and dimension the drawing.
9. Given the design requirements with the appropriate symbols, make a section drawing of a garage foundation to scale.
10. Given the floor plan for a proposed room and porch addition, draw a foundation plan showing the foundation wall and foundation footing.
11. Given several symbols for electrical fixtures, identify what each symbol represents.
12. Given the floor plan for a house and an electrical legend and fixture schedule, locate the position of electrical fixtures on the floor plan.

Writing Specifications (Goals: 6, 9, 11, 13)

1. Given situations related to writing specifications for a neighborhood playground:
   a. List some of the kinds of specifications needed to write about:
      (1) General conditions.
      (2) General requirements.
   b. Describe what you would do if some of the specified materials could not be purchased in your area.
2. Given a series of questions:
   a. Identify three items that are specified in a set of specifications.
   b. Indicate where to find the information about plumbing fixtures for a structure when starting to write specifications.

3. Given a plumbing fixture specification sheet and a builders' supply catalog, complete a plumbing fixture specification sheet by recording catalog number, description, and cost for each fixture.

The Designing and Engineering Cycle (Goals: 6, 9, 11, 16, 17)

1. Given situations related to the designing and engineering of stage sets for a school play:
    a. Write some questions you might ask to help identify the design problems.
    b. List what dimensions you would need before you start drawing to scale.
    c. Give reason why you need to know what the actors do on the stage.
2. Given a design situation, a new set of design requirements, and an unsatisfactory community park site design, redesign the park site in light of the situation and design requirements.
3. Given a series of drawings and a stapler, assemble the sheets into a set of drawings.

Selecting a Builder (Goals: 6, 8, 9, 12)

1. Given situations related to seleting a builder:
    a. Give reasons why most landowners hire a general contractor for a construction project.
    b. Give reasons why general contractors often hire subcontractors.
    c. Determine what kinds of payments are called for in different types of contracts.
2. Given the lecture and Reading 19, describe the steps commonly followed in selecting a builder.
3. Given the lecture and text reading, state four contract choices available to an owner who is having a project constructed.
4. Given a construction job, select an appropriate construction contract and give reasons why it was selected.

Contracting (Goals: 6, 8, 9, 12)

1. Given situations related to contracting:
    a. Name the kinds of information or documents that can show an owner or architect that a contractor is qualified.
    b. Give examples of what might happen if bids did not have to be responsive.

2. Given the presentation on contracting procedures:
    a. Explain what happens when a contract contains false information.
    b. Explain who is responsible for the accuracy of contract documents and why accuracy is important.
3. Given contracting procedures, bids, and a contract form:
    a. Select a bidder.
    b. Complete a contract form.
    c. Answer questions related to bid selection and contract accuracy.

Estimating and Bidding (Goals: 6, 8, 9)

1. Given situations related to estimating and bidding.
    a. Suggest the source form which a contractor or his estimator may get the following kinds of information:
        (1) Sizes and kinds of materials needed.
        (2) Labor costs.
        (3) Equipment costs.
        (4) Overhead costs.
    b. Give reasons that might cause a contractor to raise or lower the profit that is included in his bid.
2. Given a plumbing plan, plumbing costs, and the option of installing either a galvanized or copper plumbing system, estimate which system will give you the most profit.
3. Given a "Big Builder" game:
    a. Become familiar with the terms and sequence of the managed production system.
    b. Compete against opponent players in bidding for construction jobs and gaining the most profit.

Scheduling (Goals: 9, 11, 12, 13, 16)

1. Given situations related to scheduling:
    a. Suggest what might happen if a contractor made these errors in scheduling:
        (1) The inside walls were plastered and painted before an electrician arrived to install wiring.
        (2) The kitchen walls and floor were finished before the plumber did his work.
        (3) A truck arrived with ready-mixed concrete, but the forms to hold the concrete were not built.
    b. Suggest some other scheduling errors that might be very expensive mistakes.

2. Given an explanation of a bar chart and a CPM chart (critical path method):
   a. Name some types of construction jobs that require scheduling.
   b. Explain the purpose of scheduling and what each type of chart provides.
3. Given the problem of scheduling, using a bar chart and CPM chart:
   a. Schedule the operations of a job according to the sequence in which they should occur and the time required using the bar chart technique.
   b. Schedule the deliveries of materials using the CPM chart.

Working as a Contractor (Goals: 6, 16)

1. Given situations related to working as a contractor:
   a. Identify some of the responsibilities a contractor has other than making sure the correct materials are used.
   b. Name which of the following groups, in a contractors office, you would choose to work in and explain why you chose it:
      (1) Administrative.
      (2) Engineering.
      (3) Construction.
2. Given information from a lecture:
   a. Explain why a contractor should be concerned about his reputation.
   b. Explain why ethics are important.

Collective Bargaining (Goals: 3, 4, 6, 10, 12, 16, 17)

1. Given information related to collective bargaining:
   a. Give reasons why construction workers have special needs for help from a union.
   b. Name what kinds of things union members and their employer bargain about.
   c. State what a mediator can do to help settle a difference.
   d. Describe what an arbitrator does.
   e. Give reasons why a union tries to avoid a strike.
   f. Identify the kinds of activities in which labor and management usually work together.
2. Given information from a lecture:
   a. State three disadvantages and advantages of unions.
   b. Explain what could happen if there weren't any unions.

3. Given a labor management contract problem and activity as either a labor or management member:
   a. Give reasons why a new contract is or is not necessary when the old one expires.
   b. Negotiate for contract acceptance.

Hiring Construction Personnel (Goals: 2, 3, 5, 6, 7, 16)

1. Given information related to hiring construction personnel:
   a. Name several ways in which a construction contractor may recruit job applicants.
   b. Name the purpose of a hiring hall.
   c. Suggest what kinds of questions are usually asked on job application blanks and give reasons why the employer needs to know the answers.
   d. Give reasons why a contractor would want a new worker to know something about the whole construction project.
   e. Identify the kinds of rules and policies an employee needs to know.
2. Given some information by the teacher:
   a. Explain what "recruiting" means.
   b. Give some reasons why the recruiting process may be long and expensive.
   c. Name some ways of obtaining information about a job applicant.
3. Given the situation of applying for a job, play the role of (a) a personnel manager interviewing job applicants, or (b) a job applicant.

Training and Educating for Construction (Goals: 2, 3, 4, 5, 6, 7, 16)

1. Given information related to training and educating for construction:
   a. Name several jobs in each of these groups.
      (1) Managers.
      (2) Production workers.
      (3) Office workers.
   b. Identify which of these people usually work in construction, which usually work in manufacturing, and which work in both:
      (1) Aeronautical engineers.
      (2) Architects.
      (3) Civil engineers.
      (4) Electrical engineers.
      (5) Industrial engineers.

        (6) Mechanical engineers.
        (7) Sanitary engineers.
    c. Name who sets up and runs an apprenticeship program.
    d. Describe what you must do if you want to become an apprentice in a construction trade.
    e. State how much and what kinds of training are required to become a journeyman.

2. Given information from a lecture, name some of the important elements of a good apprenticeship program.
3. Given the problem of completing an apprenticeship program agreement:
    a. Indicate some of the requirements for a good apprenticeship training program.
    b. Find in a telephone directory the name of a potential employer.

Working Conditions (Goals: All)

1. Given situations related to working conditions:
    a. Suggest what parts of your classroom physical environment cannot be changed.
    b. Suggest some ways of improving the physical environment in your school.
    c. Suggest how group activities help you in getting an education.
    d. As fringe benefits:
        (1) Name what tickets for sports events or entertainment you can buy at student rates.
        (2) Determine if the school provides equipment for playing after-school sports.
2. Given a series of questions:
    a. Name the three main aspects of the working environment.
    b. Name some safety factors that must be considered in the physical environment.
    c. Name some of the considerations for a good social environment.
    d. Name some of the considerations for the economic environment.
3. Given a job title and a specific task, write a set of rules governing working conditions in the laboratory.

Advancing in Construction (Goals: 5, 6, 7, 16)

1. Given information related to advancing in construction:
    a. Compare how ambition and hard work are involved in both school and job advancement.
    b. Contrast how promotion to a foreman's job is different from promotion to the eighth grade.
    c. Explain the terms: discharging, relocating, and laying off.
    d. List what you would want to know about the advancement practices of a construction firm if you were looking for a permanent job.
2. Given a lecture and series of questions:
    a. State the approximate number of years a person can expect to work after leaving high school.
    b. Name a determining factor in the type of work and amount of income an individual can expect during his lifetime.
    c. Name six factors that will affect a worker's earnings.
3. Given lists of occupations and the approximate length of preparation time (schooling, apprenticeship), determine the approximate total incomes five years and ten years after high school graduation.

Construction Production Technology (Goals: 6, 8, 11, 13, 16)

1. Given information related to construction production technology:
    a. Identify what preprocessing is done to materials as they arrive on a site.
    b. Give reasons why a contractor does not want all the materials delivered to the site at one time.
    c. Name some materials that are processed by:
        (1) Separating.
        (2) Combining.
        (3) Forming.
2. Given a reading and a demonstration-lecture on construction production:
    a. State the construction practices that occur during the preprocessing stage of construction.
    b. State the kinds of construction practices that occur during the processing stage of construction.
    c. State the general procedure for constructing a structure.
3. Given a list of production practices, classify them as preprocessing, processing, or postprocessing.

4. Given a list of processing practices, classify them as separating, forming, or combining.
5. Given the equipment and materials, construct a site box.

Getting Ready to Build (Goals: 1, 6, 8, 9, 11, 13)

1. Given situations related to getting ready to build:
    a. Name the major kinds of zones in a city.
    b. Describe some other restrictions or limits that may apply in some areas of the city.
    c. Identify who must be protected at a construction site.
    d. Identify some dangers that workers must be protected from.
    e. Describe some ways in which the contractor provides for safety.
2. Given a site box and a construction site plan:
    a. Locate buildings, water mains, telephone lines, roads, and property lines.
    b. Locate temporary facilities where they will be most efficient.

Clearing the Site (Goals: 1, 6, 8, 9, 13, 14)

1. Given situations related to clearing a site:
    a. List the name or location of one structure or building that is in the process of being demolished in your neighborhood or city.
    b. Identify places where unwanted materials from demolished structures in your community can be placed or disposed.
    c. Find the names of two companies in your telephone directory that are involved in practices of "clearing the site".
2. Given Reading 31, a lecture on clearing obstacles and some discussion questions:
    a. Name five factors which must be considered in clearing a site.
    b. Name six practices used to clear a site.
    c. Identify the proper practice to use for specific jobs in clearing a site.
3. Given some obstacles which will interfere with a proposed construction project, identify the practice and equipment to be used for clearing the site.
4. Given a lecture on removing and disposing of obstacles,
    a. Name three ways to dispose of extra earth.
    b. Name three ways to dispose of timber.
    c. Name three ways to demolish a building.

5. Given an illustration of a building site and an efficiency chart which specifies costs, determine the most efficient technique for disposing of site obstacles and determine the cost of clearing.

Locating the Structure (Goals: 1, 6, 8, 9, 11, 13, 14)

1. Given situations related to locating the structures,
    a. Describe what you think would happen if a new home were incorrectly located and built on a portion of someone else's property.
    b. List three kinds of construction workers that would use surveying equipment to locate structures on a site.
    c. Describe a situation in which you could tell why surveyors were surveying.
2. Given a demonstration on how to locate a structure on a building site, and discussion questions:
    a. State how the batter board locations are found on the construction site by a surveyor.
    b. Tell how batter boards are constructed.
    c. State how batter boards are used in locating a building.
3. Given the equipment and supplies, a site box, and some string:
    a. Construct right-angle batter boards to be used to locate a structure on a simulated building site.
    b. Locate the outside walls of a building by running lines to points on the batter boards.
    c. Locate the four corners of a building by intersecting lines attached to batter boards.

Handling Grievances (Goals: 3, 4, 6, 7, 8, 10, 12, 17)

1. Given situations related to handling grievances:
    a. Describe the way (grievance procedure) you have of settling differences if you want to watch a particular television program, but your parents or brothers and sisters want to watch another.
    b. Describe what you think might happen on a construction project if orderly procedures for handling complaints were not agreed upon before they occur.
2. Given Reading 34, the lecture on grievance procedures, and some discussion questions:
    a. Define "grievance".
    b. Explain the reason for workers' grievances.
    c. Explain the grievance procedures used to solve a worker's grievances.

3. Given a role-playing situation concerning a labor-management grievance,
    a. Serve as a member of the grievance committee, and present the position for a satisfactory solution from the worker's viewpoint.
    b. Serve as a member of the grievance committee, and present the position for a satisfactory solution from management's viewpoint.
    c. Participate in a simulated collective bargaining session to work out a solution to a grievance problem.

Stabilizing Earth and Structures (Goals: 1, 8, 9, 11, 13)

1. Given situations related to stabilizing earth and structures:
    a. Describe what can be done to prevent the sides of excavations from caving in on workers.
    b. Tell what must be done to support an existing structure if earth is removed very close to its foundation.
2. Given a lecture on the stabilizing of earth and structures:
    a. Explain why excavation sites are trimmed and shaped.
    b. State four techniques used for -rading an excavation site.
    c. State three techniques used for stabilizing an earthen wall.
    d. Explain why an adjoining building is underpinned during excavation.
3. Given a site box filled with 2" of moist sand, two concrete blocks, and wood underpinnings:
    a. Underpin a simulated structure during the excavation of an adjacent area.
    b. Indicate the practices of trimming and stabilizing that should be performed.

Classifying Structures (Goals: 8, 11, 13, 14)

1. Given information related to types of structures:
    a. Name two structures that may not have substructures.
    b. List three superstructures and identify one as mass, one as bearing wall, and one as framed superstructure.
2. Given Transparencies 68-2, 68-3, and a lecture on identifying substructure and superstructure:
    a. Identify different kinds of superstructures.
    b. Identify different kinds of roof supports.
    c. Determine the construction processes of the sketched project.

Setting Foundations (Goals: 1, 6, 11, 13, 14, 16)

1. Given information related to setting foundations:
    a. Name the type of footing under your home, your school, and the nearest bridge. Compare and contrast their differences.
    b. Tell why the Tower of Piza in Italy leaned about 14 feet and describe what can be done to stop it from leaning any farther.
2. Given the demonstration, text reading, and some questions:
    a. State the reasons for using a foundation.
    b. Identify which foundation element is used to distribute the weight of the structure over the soil.
    c. Identify the common material used to construct most foundations.
3. Given a simulated substructure and load:
    a. Determine what happens when a load is applied with and without a spread footing.
    b. Determine what happens to the bearing surface when a load is applied to a floating footing.

Building Forms (Goals: 1, 6, 11, 13, 14)

1. Given situations related to building forms:
    a. Identify at least two concrete surfaces that were shaped against forms and tell if these were foundation forms or forms for the superstructure.
2. Given the necessary equipment, supplies, and drawings for a footing form and column form, lay out, mark, saw, and assemble the parts.

Mixing Concrete (Goals: 1, 6, 11, 13, 14, 16)

1. Given situations related to mixing concrete,
    a. Figure what length of sidewalk can be made from one cubic yard of concrete (3' x 3' x 3') if the sidewalk is to be 4" thick and 3 feet wide.
    b. Give two reasons why sidewalks or driveways of concrete may have small holes on their surfaces.
    c. List how many "ready mix" concrete mixing plants are located in your community.
2. Given a demonstration on mixing and placing concrete:
    a. State the proportions for a concrete mix.
    b. Tell what a slump test is ans why it is important.
    c. Name the steps involved in mixing and placing concrete in a footing and column form.

Setting Reinforcement (Goals: 1, 6, 11, 13, 14, 16)

1. Given information related to setting reinforcement:
   a. Give reasons why you think reinforcing steel rods are deformed (ridges on the surfaces of the rods) and consider why smooth surfaced reinforcing steel would not work as well.
   b. Look up "tensile" or "tensile strength" in the dictionary, then determine whether or not reinforcing steel in concrete will allow a solid concrete mass to "bend".
2. Given a footing and column form requiring the setting of reinforcement, measure, mark, cut, bend, seat, and tie reinforcing steel in the form.

Placing and Finishing Concrete (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given situations related to placing and finishing concrete:
   a. Identify at least one steel trowel finish, one float finish, and one broom finish on concrete surfaces around yourhome or school.
   b. Describe how weather affects concrete finishing.
2. Given the necessary equipment and supplies and a footing form set with reinforcement steel, proportion, mix, text, place, rod, screed, and finish concrete to make a concrete footing.

Completing Foundations (Goals: 1, 6, 11, 13, 14, 16)

1. Given information related to completing foundations:
   a. Describe what happens when concrete cures.
   b. List two reasons why some hardened concrete surfaces must receive a final surface finish.
2. Given the equipment and supplies, remove and clean forms and provide for concrete to cure properly.
3. Given the activity of placing concrete and stripping forms:
   a. State how long it takes for concrete to set and cure.
   b. State why concrete should be kept moist while curing.
   c. Relate personal observation of concrete work on a construction site.

Building Superstructures (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given information related to building superstructures:
   a. Classify the following superstructures as (a) mass, (b) load-bearing, or (c) framed:
      (1) Your home.
      (2) Your school.

        (3) Television tower.
        (4) Highway overpass.
        (5) Earth dam.
    b. Describe the way in which a framed structure is like the human body.

2. Given various kinds of superstructures, match each superstructure with a suitable material.

Building Mass and Masonry Superstructures (Goals: 1, 6, 11, 13, 14, 16)

1. Given information related to building mass and masonry superstructures:
    a. Give reasons why a highway or an airport runway may be considered a mass superstructure and give reasons why they may be considered as substructures.
    b. Give one example of how brick and stone are used in building construction other than being used in a load bearing wall superstructure.
2. Given the equipment and supplies, mix the mortar, lay out the area for the mortar bed, and lay and level concrete block to build a bearing wall.

Erecting Steel Frames (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given information related to erecting steel frames:
    a. Name the piece of equipment other than a derrick used to hoist steel shapes into place.
    b. Compare the advantages of steel-framed superstructures to mass superstructures and load bearing superstructures.
2. Given a set of working drawings:
    a. Read the drawings.
    b. Lay out concrete footings and columns.
    c. Assemble steel columns to the concrete footings.
    d. Assemble brackets to the steel columns.
    e. Erect a steel frame.
3. Given a problem of erecting a steel frame:
    a. Demonstrate skill in assembly using full-size materials.
    b. Demonstrate skill in aligning by squaring, leveling, and plumbing the columns and beams of the steel frame.
    c. Demonstrate the operation of a boom by operating, rigging, hoisting, and setting steel by use of hand signals.

Erecting Concrete Frames (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given information related to erecting concrete frames:
    a. Give reasons why the concrete used in concrete-formed superstructures must be stronger than the concrete used in foundations.
    b. List some advantages of using precast concrete shapes and give reasons why more or less precast structural members will be used in the future.
2. Given the instructions, illustrations, and specifications,
    a. Build forms for making concrete frames.
    b. Construct, plumb, and level shoring members.

Building Wood Frames (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given situations related to erecting wood frames:
    a. Give reasons why wood framing is used for structures such as houses.
    b. Compare the advantages and disadvantages in building wood-frame structures in a factory and transporting them to the site.
2. Given the equipment, supplies, and instructions, measure, mark, and saw materials to length and assemble the rough floor framing of a model structure.
3. Given a wood floor structure, construct bridging in the floor structure and install the subfloor.
4. Given a wood frame floor structure, lay out the wall plates and studs, cut them to length, and assemble the wall sections.
5. Given the wood frame structure, construct and install the window frame, header and double plates.
6. Given a wood frame wall and floor structure, lay out, construct, and erect the roof trusses.
7. Given the completed frame structure, inspect the structure and evaluate the findings.

Inspecting Wood Frames (Goals: 1, 6, 8, 9, 14, 16)

1. Given the new laboratory manuals for the second semester, code the manuals for organization, identification, distribution, and collection.
2. Given the inspection checklist for the wood frame structure, correct any deficiencies.

Installing Utilities (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given situations related to installing utilities:

  - a. Name what utilities service your home and name other utilities which are used in your community.
  - b. Describe some of the problems you would have if all the utilities you use were suddenly shut off.
  - c. Describe some utility construction now going on near your home or school.

2. Given the term "utility systems", define the concept.
3. Given the three common types of utility distribution networks--ducting, piping, and wiring:
   - a. Point out examples of each in the school laboratory.
   - b. Name other examples in homes.
4. Given that there are utility plants in their community or nearby, name some specific plants.

Installing Heating, Cooling, and Ventilating Systems (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given information related to installing heating, cooling, and ventilating systems:
   - a. State four ways in which air can be changed or "treated".
   - b. Name several devices that control temperature, humidity, or the flow of air in a room.
   - c. Give reasons why it might be easier to install ductwork before plumbing or wiring.
2. Given the names of several devices and functions concerning heating, cooling, and ventilating systems, associate each device and each function with treating air, circulating air, or controlling some part of the system.
3. Given the equipment, supplies, and instructions:
   - a. Lay out, cut, and bend three pieces of sheet metal to form a boot, boot cap, and round duct.
   - b. Fasten together the ends of a formed duct, and fasten together the ends of a formed boot with seam joints.
4. Given a sheet metal boot, boot cap, and round duct, assemble the ductwork with a dovetail joint and hseet metal screws.
5. Given a sheet metal boot assembly and structure,
   - a. Lay out the location of the duct opening on the subfloor.
   - b. Saw out the subfloor opening.
   - c. Install the ductwork in the structure.

Installing Plumbing Systems (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given situations related to installing plumbing systems:

   - a. Name two separate piping systems required for most structures.
   - b. List four materials carried through plumbing systems.
   - c. Name the person whose trade or craft has prepared him to install piping systems in your home.

2. Given a steel tape and try square, lay out the locations for plumbing lines on a structure.
3. Given a brace and bit, bore holes for installing plumbing lines.
4. Given galvanized pipe and a pipe cutter, cut pipe to length.
5. Given a pipe die and stock, cut threads on galvanized pipe.
6. Given pipe wrenches, pipe, and fittings, assemble the pipe and fittings.

Installing Piping Systems (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given information related to installing piping systems:
   - a. Compare and contrast plumbing systems to pipeline systems.
   - b. Name two pipeline systems in your community, one above ground and the other below ground, and give the purpose of each.
2. Given the necessary equipment and supplies:
   - a. Cut and ream copper tubing.
   - b. Flux, assemble, and sweat-solder copper tubing and fittings.
3. Given the necessary equipment and supplies and a structure:
   - a. Measure the distance between studs.
   - b. Lay out and cut a backing board and nailer.
   - c. Install the backing board and nailer.
4. Given the equipment, supplies, and partially installed copper tubing and galvanized pipe assemblies, secure the tubing assembly and the pipe assembly to the backing board.
5. Given samples of several piping materials not used in the laboratory activity (e.g., cast iron pipe, plastic pipe, clay soil pipe), identify each material and state ways in which each might be used.
6. Give the necessary equipment and supplies, complete the installation of hot water and cold water lines in their structure.

Installing Electrical Power Systems (Goals: 1, 6, 11, 12, 13, 14, 16)

1. Given situations related to installing electrical power systems:
   - a. Describe some differences between outside and inside construction electrical power systems.
   - b. Trace the outside electrical construction from power plant, transformers, distribution lines, and drop line to your home.

   c. Locate the three main elements of inside electrical construction in your home: entrance, distribution panel, and branch circuits.

2. Given the necessary equipment and supplies,
   a. Lay out the wiring run for the electrical wiring system.
   b. Drill holes as marked for the electrical system, following safe and proper procedures.
   c. Install electrical outlet boxes.

Making Inspections (Goals: 6, 8, 9, 14, 16)

1. Given information related to making inspections:
   a. Give reasons why inspections are made at the construction site and state when they are made.
   b. Give reasons why building codes are important to the local inspector and why he should be familiar with these codes.
2. Given the necessary equipment and supplies, complete the rough wiring of a structure.
3. Given a steel tape, wire gauge, and checklists:
   a. Inspect the rough wiring in a structure, and note corrections needed.
   b. Inspect the plumbing in a structure, and note corrections needed.

Mediating and Arbitrating (Goals: 3, 4, 10, 12)

1. Given information related to mediating and arbitrating:
   a. Define the difference between mediation and arbitration.
   b. Give a reason why the process of arbitration is rarely used in the construction industry.
2. Given a jurisdictional dispute (hypothetical) involving two crafts, participate as a mediator, an arbitrator, or a union representative.

Enclosing Framed Superstructures (Goals: 1, 6, 11, 12, 13, 14)

1. Given situations related to enclosing framed superstructures.
   a. Name the kinds of exterior materials used to enclose your school.
   b. Identify the materials that enclose the frame or bearing walls of your industrial arts laboratory.
2. Give the necessary equipment and supplies, prepare and install the wall sheathing on their structures.

Roofing (Goals: 1, 6, 13, 14)

1. Given situations related to roofing:
   a. Give reasons why there are more flat or pitched roofs in your part of the United States.
   b. Give reasons why there is or is not evidence of a leaking roof in the ceiling in the room in which you are sitting.
2. Given that there are two main types of roofs, name them.
3. Given that there are several steps in laying a built-up roof, name them.
4. Given a structure, equipment, and supplies:
   a. Nail roof sheathing to the upper chords (rafters).
   b. Measure, cut, and apply building felt with a staple gun.
5. Given a structure, equipment, and supplies:
   a. Apply three courses of an asphalt shingle roof.
   b. Assemble a window frame.

Enclosing Exterior Walls (Goals: 1, 6, 13, 14)

1. Given situations related to enclosing exterior walls:
   a. Explain why the exterior surface of a framed building is sometimes called the "skin" of the building.
   b. Name the most common type of "skin" or exterior surface on buildings in your neighborhood.
2. Given the necessary tools and equipment:
   a. Apply building felt to the exterior walls of a structure.
   b. Lay out, cut, and install vertical siding on the gable end of a structure.
3. Given a wood frame structure and necessary equipment and supplies:
   a. Install soffit.
   b. Measure, cut, and install return fascia and rake.

Striking (Goals: 3, 4, 10, 12)

1. Given situations related to striking:
   a. If there has been a strike in the construction industry in your locality within the past few months, tell what brought it about.
   b. Identify who loses and why, when a strike occurs.
2. Given questions:
   a. State four conditions under which the government may intervene in settling a strike.

   b. State three ways the government can aid in settling strikes.

3. Given a hypothetical labor-management dispute and resulting strike, participate as a negotiator, an observer, or a member of a picket line.

Insulating (Goals: 1, 6, 13, 14)

1. Given situations related to insulating:
   a. Give reasons why it would be better to have or not to have insulation in the walls and ceilings if your home caught on fire.
   b. Tell how you could find out if there is any insulating material in the outside walls and the ceilings of your home.
2. Given questions:
   a. State three uses for insulation.
   b. Identify four common forms of insulation.
3. Given the necessary equipment and supplies, measure, cut, and install blanket insulation.

Applying Wall Materials (Goals: 1, 6, 13, 14)

1. Given situations related to applying wall materials:
   a. Identify the kinds of wall materials used to cover interior walls in your bedroom, living room, and bathroom, and give reasons why the materials are the same or different.
   b. Describe the major difference between the interior walls of your school classrooms and those in your home.
2. Given the necessary equipment and supplies, measure, cut, and install gypsum board (drywall) to cover the inside of the long wall of the structure.
3. Given the necessary equipment and supplies, apply joint cement and joint tape to an interior wall surface.

Applying Ceiling Materials (Goals: 1, 6, 13, 14)

1. Given situations related to applying ceiling materials:
   a. Give reasons why ceilings are installed in buildings and name a few buildings you know of that have rooms with no ceilings.
   b. Describe what can be done if a ceiling in an older home or building develops bad cracks or begins to fall down.
2. Given the text reading and a demonstration:
   a. State three reasons why ceilings are enclosed.
   b. Name three types of drywall ceiling materials commonly used in house construction.

3. Given the necessary equipment and supplies, measure, cut, and install furring strips and ceiling tile.

Laying Floors (Goals: 1, 6, 13, 14)

1. Given situations related to laying floors:
    a. Name the material used to cover the floor in your industrial arts laboratory and tell why it is the same or different than the flooring material in rooms in your home.
    b. Count the number of companies in your local telephone directory which specialize in applying flooring materials.
2. Given questions related to flooring:
    a. Identify at least five different flooring materials.
    b. Name four basic types of adhesives.
    c. Give a reason why long-wearing floor materials are used in commercial buildings.
3. Given the necessary equipment and supplies, lay vinyl floor tiles.

Finishing the Project (Goals: 1, 6, 14)

1. Given situations related to finishing the project:
    a. List several tasks that had to be done to finish out the construction in your home or your school.
    b. Give two examples of finishing practices that must be used before a superhighway can be opened to traffic.
2. Given the necessary equipment and supplies, install an interior window casing.
3. Given questions:
    a. State two reasons for not using a miter joint at an interior corner when installing trim moldings.
    b. State two reasons why trim pieces are joined at interior corners with coped joints.
4. Given the necessary equipment and supplies, install baseboard, base shoe, and cove molding.

Painting and Decorating (Goals: 1, 6, 14)

1. Given situations related to painting and decorating:
    a. Explain in what ways the specifications for paint used to line highways differ from the specifications for paint used on your walls or woodwork at home.
    b. List the decorating materials that were used to decorate your home.

2. Given the necessary equipment and supplies, prepare exterior and interior surfaces for painting.
3. Given the necessary equipment and supplies, apply paint to exterior and interior surfaces.

Installing Accessories (Goals: 1, 6, 12, 13, 14)

1. Given situations related to installing accessories:
    a. Explain the difference between a fixture and a furnishing, and locate three of each in the room you are now in.
    b. Name what fixtures or accessories would need to be installed on a new playground and a new football field with track and field facilities.
2. Given the necessary equipment and supplies, follow proper procedures in installing a duplex convenience outlet, a porcelain lamp receptacle, and a toggle switch to complete a grounded electrical system in the structure.
3. Given the necessary equipment and supplies, connect a grounded (three-prong) male plug to the electrical system.

Completing the Site (Goals: 1, 6, 8, 10, 11, 13, 16)

1. Given a situation related to completing the site, make a drawing (plan view) of your home or school site and locate and label accesses, exterior features such as patios and fences, plantings such as trees or bushes, and other objects or features that were placed there when the site was completed.
2. Given a text reading and lecture:
    a. State three ways in which plants are useful.
    b. Describe the job of a landscape architect.
    c. Explain why and how a plant's root system is protected during transplanting.
3. Given the necessary equipment and supplies, prepare soil and properly plant a tree, shrub, or other plant appropriate to your area.

Transferring the Project (Goals: 8, 9, 11, 13, 17)

1. Give information related to transferring the project:
    a. Tell when a project is closed and what this means to the contractor and owner.
    b. Give some examples of punch list items for a new highway and a new house.
2. Given the necessary equipment and supplies, complete a punch-list form, a warranty form, and a release form.

Servicing Property (Goals: 1, 10, 11, 13, 14, 16)

1. Given information related to servicing property:
    a. Explain how postprocessing differs from processing and tell why postprocessing is important in construction.
    b. List several servicing activities that should be carried out to improve the condition of a street, highway, or bridge in your community.
2. Given the necessary equipment and supplies, perform needed servicing activities on their structure as determined by a prior inspection.

Constructing Housing (Goals: 6, 8, 15, 16, 17)

1. Given situations related to constructing housing:
    a. Give reasons why there is a great demand for more housing units now than ever before in history.
    b. Identify whether more of your classmates live in apartments or single family homes and explain why the greater of the two is growing more rapidly.
2. Given a series of questions, explain the functions of various rooms in a home.
3. Given their homes as reference, determine whether the number of rooms and their sizes are adequate.
4. Given the construction laboratory, estimate its size by pacing off distances.

Your Dream House (Goals: 8, 9, 16, 17)

1. Given situations related to your dream house:
    a. Give some reasons why the houses you and your friends live in may or may not be the most ideal house.
    b. List what you can do now and within the next 15 to 20 years to help you obtain your ideal or dream house.
2. Given that family size, activities, and occupational demands are factors to consider, state one particular family's physical requirements for a house.
3. Given pictures depicting nine common architectural styles, and a list of identifying characteristics, associate each description with the correct picture.
4. Given forms, charts, and maps, decide the following:
    a. Physical requirements for a dream house.
    b. Economic status and cost of housing.

  - c. Geographic conditions and materials available.
  - d. Architectural style..

Selecting and Purchasing a Lot (Goals: 8, 9, 16, 17)

1. Given information related to selecting and purchasing a lot:
   - a. List what things you should consider when you are deciding what community you would like to live in.
   - b. Give reasons why lawyers, realtors, and banks are important in the process of selecting and purchasing a piece of land.
2. Given a checklist dealing with size, shape, topography, utilities, services, and prices of lots, select an appropriate lot for a dream house.
3. Given an "Offer to Purchase" form, complete it for a dream house lot.

Planning the Living Space (Goals: 6, 8, 9, 10, 12)

1. Given situations related to planning the living space:
   - a. Identify which basic activities require the most space in your present home.
   - b. Make a sketch of the floor plan of your home and note the traffic pattern for a typical day.
2. Given information from a lecture:
   - a. Explain why basic and nonbasic activities are considered in planning room arrangement.
   - b. Explain why the noisy and quiet areas of a house are separated.
   - c. Explain what is meant by "traffic flow" within a house.
3. Given a checklist of rooms and size, select those that are appropriate for their dream house.
4. Given two charts and a square-footage table, estimate the cost of the floor area of their dream house.

Planning the Living Space (Goals: 6, 9, 10, 12)

1. Given the rooms in a house:
   - a. Explain four basic activity areas.
   - b. Explain four nonbasic activity areas.
2. Given rooms and their sizes from Activity 78A, group them into basic and nonbasic areas.
3. Given the space relationships of basic and nonbasic areas, develop a workable floor plan for a dream house.

Preparing Working Drawings (Goals: 6, 9, 10, 12)

1. Given information related to preparing working drawings:
    a. Explain what would happen if a builder or contractor tried to build a house without the necessary drawings.
    b. Give reasons why the floor plan is considered to be the most important working drawing.
2. Given a text reading and lecture about working drawings, name the kinds of working drawings needed for house construction.
3. Given the kinds of working drawings needed for house construction, explain the importance of the floor plan.
4. Given a rough floor plan including the basic rooms arranged in proper relationship:
    a. Refine the floor plan to include closets and halls.
    b. Establish final exterior wall location and shape.
5. Given a basic unit cost of $15 per square foot, figure a cost estimate for a dream house.
6. Given a refined dream house floor plan:
    a. Locate and lay out doors and windows.
    b. Prepare a tracing that shows overall dimensions, room names, and sizes.
7. Given a dream house floor plan, trace wall lines and prepare a foundation drawing.
8. Given a floor plan tracing, show the locations of electrical light fixtures, switches, and convenience outlets.
9. Given a series of questions:
    a. Name the four views found in elevation drawings.
    b. Explain how to compute the slope of a roof if the run and rise are known.
    c. Explain five of the lines found in elevation drawings.

Writing Specifications (Goals: 6, 9, 10)

1. Given situations related to writing specifications:
    a. Explain how specifications protect the interests of the architect, the builder, and the owner.
    b. Identify what problems might come up if the specifications are not complete.
2. Given a lecture on the use of catalogs, explain what kind of information is needed to complete specification schedules for doors, windows, and room materials.

3. Given a room material specification chart and catalogs, select suitable materials for walls, ceilings, and floors of a dream house.
4. Given elevations and a floor plan, window or door schedules, and catalogs, specify suitable sizes and styles of doors and windows for a dream house.

Financing and Contracting (Goals: 9, 10, 12, 15, 16)

1. Given information related to financing and contracting:
   a. Explain how mortgage interest rates affect the size home you can buy.
   b. Describe the kind of experience and training you would need to act as an owner-builder without any contract.
2. Given three types of contracts, identify the type they would prefer in contracting for their dream house.
3. Given the various types of lending institutions, explain what information is needed when applying for a loan and for a contract.
4. Given a sample contract form, complete the agreement for building a dream house.
5. Given a mortgage loan amount and an interest rate, figure the first month's interest on the loan.

Building the Substructure (Goals: 1, 11, 12, 13, 14, 16)

1. Given situations related to building the substructure:
   a. Identify what excavation problems would limit the use of basements in your community.
   b. Give reasons why it is important to strip off and save topsoil during the clearing operation.
2. Given the problem of constructing a residential building:
   a. Explain what is involved in clearing the site.
   b. Explain who does site layout, how it is done, and the use of batter boards.
3. Given a floor plan and the necessary materials and equipment, cut out a floor plan, cement it to slab foundation material, and saw around the floor plan.

Building Walls (Goals: 1, 11, 12, 13, 14, 16)

1. Given situations related to building walls:
   a. Give reasons why you think 2" x 4" studs are commonly placed 16" on center in walls.
   b. Identify the style of wall construction used in your school building and state whether or not this style is often used on homes.

2. Given a demonstration on how to lay out and cut model walls, doors, and windows, state the procedures and materials used to lay out and cut out walls.
3. Given wall material, model house floor plans, and elevations, lay out and cut out exterior walls.
4. Given demonstrations on how to cut doors and windows and how to erect walls, state the procedures and materials to be used to erect walls for their own model houses.
5. Given the necessary equipment and supplies, assemble the wall sections of a model home on the slab foundation.

Building Floors and Ceilings (Goals: 1, 11, 12, 13, 14, 16)

1. Given situations related to building floors and ceilings:
   a. Identify whether or not the floors in your home are constructed of wood, frame, or concrete, and compare your floor construction to others in your neighborhood.
   b. Give reasons why metal is not a commonly used material in home floor or ceiling construction.
2. Given a demonstration on how to lay out, cut out, and erect interion walls:
   a. State how to check a wall for squareness.
   b. State the height of interior doors and openings they will use.
3. Given a floor plan and the necessary equipment and supplies, lay out, cut, and erect the interior walls of the dream house.

Building Roofs (Goals: 1, 11, 12, 13, 14, 16)

1. Given situations related to building roofs:
   a. Identify what style of roof your home has and compare it to the roof styles of your neighbors' houses.
   b. Describe how the seasons and weather affect roof design in your city.
2. Given a demonstration on laying out and cutting roof trusses and sheathing:
   a. Explain the terms "run", "rise", and "span".
   b. Tell how to make a template for a roof truss.
   c. Explain how to determine the size of roof sheathing.
3. Given a model structure, plans, equipment, and supplies, lay out and cut out roof trusses and roof sheathing for the dream house.
4. Given a demonstration, those students who have planned an intersecting gable roof will lay out and fit the roof for their dream house.

5. Given model structure plans, equipment, and supplies, assemble the roof section for a dream house.
6. Given a model house and supplies, complete the roofing.
7. Given information about suggested materials that can be used for landscaping, begin looking for materials that can be utilized.

Enclosing Exteriors (Goals: 1, 11, 12, 13, 14, 16)

1. Given situations related to enclosing exteriors:
   a. Identify what building material for exterior walls is most common in your neighborhood.
   b. Describe how exterior walls of a home might be covered 30 years from now, and tell why they might be covered that way.
2. Given a lecture-demonstration on finishing and finishing materials, answer questions about the following:
   a. Types of paint.
   b. Thinners for paints.
   c. Application of paints on surfaces.
   d. Care of brushes.
3. Given tempera paint, paint the roof of the dream house.
4. Given latex paint, paint the exterior walls of the dream house.

Roughing in Utilities (Goals: 1, 11, 12, 13, 14)

1. Given information related to roughing in utilities:
   a. Give reasons why the heating utilities are foughed in before plumbing or electrical utilities.
   b. When homes are built in factories, explain whether or not utilities will be installed on the site or in the factory and explain where utilities will be connected.
2. Given a demonstration, state how to cut and install windows and doors for the dream house.
3. Given working drawings, equipment, and supplies, prepare and install windows, doors, and miscellaneous fixtures in the dream house.

Working on the Interiors (Goals: 1, 11, 12, 13, 14)

1. Given information related to working on the interior:
   a. Name the different types of tradesmen or craftsmen that would be employed to finish out a newly built home.
   b. Name what interior work, if any, can be done during or before exterior work and the roughing in of utilities, and explain why.

2. Given a series of questions:
    a. Name some of the forms of insulation materials.
    b. Name some techniques of enclosing walls and ceilings.
    c. Identify the trim pieces used in door construction.
3. Given a model house, working drawings, equipment, and supplies, complete the exterior of the dream house.

Completing the House (Goals: 1, 11, 12, 13, 14)

1. Given situations related to completing the house:
    a. Give reasons why fixtures and accessories should not be installed before painting and decorating.
    b. List the different fixtures and accessories that are in your kitchen and identify what room in your house has the most fixtures and accessories.
2. Given a series of questions:
    a. Define what is meant by "decorative coating".
    b. Name three general kinds of cabinets.
    c. Explain why the careful installation of fixtures and accessories is so important.
3. Given a model house, equipment, and supplies, complete the interior of the dream house.

Planning Community Services (Goals: 8, 9, 10, 14)

1. Given situations related to planning community services:
    a. Describe what could be done to move automobile traffic faster.
    b. Identify the source of your drinking water and explain why there is or is not a shortage of water.
2. Given the Apollo County map:
    a. Determine appropriate water plant and sewage plant sites.
    b. Estimate the capacity and cost of water and sewage utilities.

Housing People (Goals: 8, 9, 10, 14)

1. Given information related to housing people:
    a. Tell how you can determine if you live in low density, medium density, or high density housing.
    b. Explain why high density housing is usually found close to places of major employment.
2. Given a map of Sonic City:
    a. Determine the type and number of houses for 3,320 people.
    b. Determine the profit or loss of a land developer.

Planning Business Facilities (Goals: 8, 9, 10, 14)

1. Given situations related to planning business facilities:
    a. Identify the central business area in your community and explain why new shopping centers have or have not been developed.
    b. Tell how a high-speed mass transportation system would affect the central business district of a large city and state, whether or not you think central businessmen would support building one.
2. Given the Apollo County map and charts, select the site and figure the cost of developing a local shopping center and central business districts in the community.

Planning Schools and Recreational Facilities (Goals: 8, 9, 10, 14)

1. Given situations related to planning schools and recreational facilities:
    a. Estimate the number of housing units served by your school.
    b. Explain how you could determine whether or not your community has adequate recreational facilities.
2. Given the Apollo County map and charts:
    a. Select the appropriate sites for school and park construction.
    b. Figure the costs of school and park construction.

The Economics of Community Development (Goals: 14, 15)

1. Given situations related to the economics of community development:
    a. Name what area or areas in your city or community are deteriorating.
    b. Describe any plans you know of to improve your community by rebuilding parts of it.
2. Given the Apollo County map and charts:
    a. Figure the loss of money due to reduced employment at Sonic Jet.
    b. Figure the loss of money due to environmental value in Sonic City.
    c. Figure the developer's total loss due to deterioration in Sonic City.
    d. Identify two urban renewal projects to be constructed in Apollo County.

EXPLORATORY INDUSTRIAL CAREER PROGRAM

MAZAMA MID-HIGH SCHOOL

KLAMATH FALLS

(FOR DISCUSSION ONLY)

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EXPLORATORY INDUSTRIAL CAREER PROGRAM
Mazama Mid-High School
Klamath Falls
(for discussion only)

Tentative Program Goals--Grade Nine (Level I)

1. To acquaint students with the materials and processes of the woodworking and wood products industry.

2. To acquaint students with the materials and processes associated with the metalworking field.

3. To acquaint students with the major concepts of the visual communications field.

4. To acquaint students with the major concepts of the electricity/electronics field.

5. To acquaint students with the major concepts of the field of energy conversion and power transmission.

6. To develop understanding of the ways in which these technologies are used in productive society; manufacturing, construction, retailing, banking, and distribution (KNOWING).

7. To create awareness of the roles of people in organizations and generate understanding of forces which impinge upon individuals and groups in various positions in the world of work (DOING).

8. To improve the competence level of the students in regard to the choosing, buying, and using the services and goods of an industry.

9. To assist students in recognizing the economic and social values that different forms of work have in our society.

Tentative Program Goals--Grade Ten (Level II)

1. To provide a setting which relates how mathematics, physics, chemistry, and other disciplines are utilized in the productive world.
2. To acquaint and align young people with employment opportunities and academic preparation required for different career patterns.
3. To provide opportunities for bridging knowledge of industrial vocations and related avocational pursuits and hobbies.
4. To make available the opportunity to select a realistic choice of career clusters available in the senior high school.

Materials and Processes Course Goals (Woods/Metals)

The student will:

1. Identify and describe a variety of jobs which require understandings of the materials and processes used in industry.
2. Demonstrate safe work habits and attitudes.
3. Demonstrate desirable work behaviors.
4. Demonstrate ability to remove industrial materials using appropriate techniques.
5. Use appropriate materials and processes to combine and assemble materials.
6. Given a problem, identify, select, and process appropriate materials.
7. Given a mass production problem, identify, select, and apply appropriate industrial functions.
8. Relate personal interests and abilities to work performed.
9. Make tentative career decisions.

Visual Communications Course Goals

The student will:

1. Identify and describe a variety of job opportunities in the visual communications field.
2. Demonstrate safe work habits and attitudes.
3. Demonstrate desirable work behaviors.
4. Communicate effectively with others using visuals.
5. Demonstrate the ability to design visuals.
6. Present and display ideas through appropriate visual media.
7. Reproduce visuals, using appropriate techniques.
8. Store and retrieve visuals, using appropriate techniques.
9. Demonstrate understanding of the communications industry, its organization, systems, and employment opportunities.
10. Relate personal interests and abilities to work performed.
11. Make tentative career decisions.

Electricity/Electronics Course Goals

1. Identify and describe a variety of job opportunities in the electrical field.
2. Demonstrate safe work habits and attitudes.
3. Demonstrate desirable work behaviors.
4. Demonstrate understanding of energy; theory, conversion, and transmission.
5. Perform basic electrical input and output measurements.
6. Apply the concept of control to electrical devices.
7. Perform basic service analysis and troubleshooting procedures.
8. Relate personal interests and abilities to work performed.
9. Make tentative career decisions.

Energy Conversion and Power Transmission Course Goals

The student will:

1. Identify and describe a variety of job opportunities in the energy and power field.
2. Demonstrate safe work habits and attitudes.
3. Demonstrate desirable work behaviors.
4. Demonstrate understanding of historical aspects of power development.
5. Demonstrate that he understands that sources of energy are either continuous or exhaustible.
6. Demonstrate understanding of the effects utilization of natural fuels has on the environment.
7. Demonstrate understanding and application of both basic and complex machines.
8. Demonstrate understanding of heat engines, their operation, basic hardware, support systems, and utilization.
9. Demonstrate an understanding of the operating principles of piston, rotary, turbine, and rocket engines.
10. Demonstrate understanding of mechnical power transfer through use of gears, belts, pulleys, and chains and sprockets.
11. Demonstrate understanding of the clutch, its functions and applications.
12. Assemble, operate, and analyze basic fluid power systems.
13. Relate personal interests and abilities to work performed.
14. Make tentative career choices.

MATERIALS AND PROCESSES
PERFORMANCE INDICATORS*

The student will:

Turning Materials (Goals: 1, 2, 3, 4, 6, 8, 9)

1. Identify common turning tools used with wood and metal materials.
2. Demonstrate the safe and proper use of selected wood and metal turning tools.
3. Write an occupational description and worker profile of jobs which involve turning operations.
4. Demonstrate the safe and proper way to sharpen selected wood and metal turning tools.
5. Select proper feeds and speeds for equipment and material.
6. Design and turn different materials to acceptable trade tolerances.

Shaping (Goals: 1, 2, 3, 4, 6, 8, 9)

1. Identify common shaping tools used with wood and metal materials.
2. Write an occupational description and worker profile of a selected job which involves shaping operations.
3. Remove material from irregular shape to specifications.
4. Demonstrate the safe and proper use of shaping equipment.
5. Demonstrate the safe and proper method of sharpening selected shaping tools.
6. Describe the wedge concept as it relates to shaping.

Mechanical Planing (Goals: 1, 2, 3, 4, 6, 8, 9)

1. Identify the names of planing tools and equipment.
2. Write occupational descriptions and worker profiles of jobs which involve planing operations.

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*The levels (I or II) at which specific performance indicators have application are not specified. Such decisions are better left to those working at each level.

3. Remove stock by hand and machine to rough size.

4. Demonstrate the safe and proper use of selected planing equipment.

5. Explain how the wedge concept is used in planing equipment.

Drilling (Goals: 1, 2, 3, 4, 6, 8, 9)

1. Identify common drilling tools.

2. Write an occupational description and worker profile of a selected job which involves drilling operations.

3. Perform simple drilling operations according to specifications.

4. Demonstrate the safe and proper use of selected drills.

5. Explain how the wedge concept is used in drills.

6. Set up drilling equipment and drill stock as per specifications.

Boring (Goals: 2, 3, 4, 6, 8)

1. Identify the different kinds of boring tools.

2. Perform simple boring operations.

3. Demonstrate the safe and proper operation of selected boring tools and instruments.

4. Explain the boring concept as it applies to a moving cutter and a stationary cutter.

Shearing (**Goals**: 1, 2, 4, 6, 8, 9)

1. Identify and name common shearing tools.

2. Pass a written safety test covering operation of shearing tools and equipment.

3. Write an occupational description and worker profile of a selected job which uses shearing operations.

4. Perform simple shearing operations within acceptable tolerances.

5. Demonstrate the safe and proper operation of selected shearing tools.

Milling (Goals: 1, 2, 4, 6, 8, 9)

1. Write occupational descriptions and worker profiles of jobs which include milling operations.
2. Identify and select proper milling devices.
3. Remove material through milling operations as per specifications.
4. Demonstrate proper and safe use of selected milling machines.
5. Explain how the wedge concept is used in milling cutters.
6. Explain how some milling machines cut without using mechanical cutters.
7. Mill materials to within acceptable trade tolerances.
8. Set up milling machines to perform various operations on different metals.
9. Pass a written test on milling machine safety practices.

Mechanical Cutting (Goals: 2, 3, 4, 6, 8)

1. Identify common cutting tools.
2. Perform basic cutting procedures using common cutting tools.
3. Demonstrate safety and proper operation of selected cutting tools.
4. Explain how the wedge concept is used in cutting tools.

Heat Cutting (Goals: 2, 3, 4, 6, 8)

1. Cut appropriate materials with a hot wire.
2. Demonstrate safe and proper friction cutting procedures.
3. Cut materials safely and properly using various methods.

Coating (Goals: 1, 2, 5, 6, 8, 9)

1. Apply coatings to different materials using various methods.
2. Identify various coating materials.
3. Write occupational descriptions and worker profiles of jobs which involve coating and spraying operations.
4. Provide proper care for coating equipment and materials.
5. Restore and maintain various coatings.
6. Select, test, evaluate, and apply coatings as per specifications.

Positioning (Goals: 2, 3, 5, 6, 8)

1. Perform all manner of assembly operations according to safe practices and to specifications.
2. Identify three common positioners and explain how they differ.
3. Demonstrate the safe and proper operation of positioning devices.
4. Explain the importance of positioners to mass production and assembly.
5. Set up and use various positioners to within given tolerances.
6. Construct and use a positioning device in conjunction with the solution of a positioning problem.

Mixing (Goals: 2, 3, 5, 6, 8)

1. Identify various mixing processes.
2. Identify and demonstrate safe and proper procedures used in a selected mixing process.
3. Differentiate between mechanical and chemical mixing processes.

Laminating (Goals: 2, 3, 5, 6, 8)

1. Identify tools used in laminating.
2. Demonstrate the set up and operation of laminating processes.
3. Explain the concept of laminating.
4. Perform work in a safe manner.

Forming (Goals: 1, 2, 3, 6, 8, 9)

1. Identify the names of various form processes.
2. Write occupational descriptions and worker profiles of jobs which involve forming occupations.
3. Demonstrate the safe and proper use of selected forming processes and equipment.

Heat Treating (Goals: 1, 2, 3, 6, 8)

1. Describe common heat treating processes and explain the differences between them.
2. Write occupational descriptions and worker profiles for jobs which involve heat treating operations.

3. Perform basic heat treating exercises in a safe and proper manner.
4. Demonstrate proper work habits while performing heat treating exercises.
5. Demonstrate an understanding of the fact that chemical changes take place while heat treating.
6. Test metal for hardness.
7. Write out a definition of heat treating.
8. Pass a written test on heat treating and hardness testing.

Measurement (Goals: 2, 3, 6)

1. Identify the names of measuring tools and equipment.
2. Use selected measuring instruments to make appropriate measurements.
3. Demonstrate the correct use of selected measuring devices.

Identification (Goals: 2, 3, 6, 8)

1. Identify various industrial materials with 90 per cent accuracy.
2. Use appropriate test equipment to identify selected industrial materials.

Industrial Functions (Goals: All)

1. Maintain predetermined, uniform rates of product excellence during an on-going production activity.
2. Coordinate facilities and movement of goods through an entire manufacturing cycle.
3. Investigate uses of improved materials, better equipment, and processes.
4. Bring an abstraction (idea) into a feasible stage fit for ultimate sale.
5. Process raw materials into finished products suitable for sale.
6. Finance a group production activity.

VISUAL COMMUNICATIONS
Performance Indicators

The student will:

Communicating with Visuals (Goals: 1,2,3,4,10)

1. Explain how people absorb information through the senses.
2. List ten potential barriers to communication.
3. Identify major events in the history of visual communication.
4. List and classify local forms engaged in producing visual communication materials.
5. Identify employment and career opportunities in a selected industry.
6. Compare and contrast various visual media.
7. Analyze the visual communication process and list the steps involved.
8. Formulate individual ideals and set personal goals.
9. Describe the visual communication process.
10. List the basic steps in audience analysis.
11. List the basic advantages and disadvantages of major presentation processes.
12. Describe three recent developments in the visual communication industry.
13. Describe major advantages and limitations of four methods of reproduction.
14. Given a communication problem, prepare a flow chart of operations and procedures to be used to solve the problem.
15. Describe the basic procedures for evaluation of visual communiques.
16. Observe the environment; react to and express what is seen.
17. Describe different levels of creativity.

Symbols (Goals: 1,2,3,5,10)

1. Describe how ideas are translated into visual symbols.
2. Apply symbols in solution of graphic problems.

3. Produce a series of symbols of reproduction quality and use them in producing complete visuals.

4. Select an idea and design a symbol to represent it.

5. Develop semi-finished and final designs of reproducable quality.

6. Describe how symbols affect societal groups.

Preparation (Goals: 1,2,3,5,10)

1. Analyze proof sheets of photos and crop to improve quality.

2. Develop designs and prepare paste-ups.

3. Identify employment and career opportunities related to the production of designs for visual communications.

4. Demonstrate development of perceptual awareness and aesthetic judgment by evaluating selected materials.

5. Apply proof marks to correct copy.

6. Apply design fundamentals, using photographic and/or graphic processes.

7. Mask copy for setting with full details for the printer.

8. Produce designs used in a visual communication.

9. List major requirements for employment in jobs related to design and layout.

Size and Shape Description (Goals: 1,2,3,5,9,10)

1. Apply sketching and mechanical aids to render technical illustrations.

2. Sketch and identify isometric, oblique, orthographic projections, and geometric construction.

3. Sketch and identify three types of oblique drawings: a) cavalier, b) cabinet, and c) general.

4. Demonstrate knowledge of the principles of orthographic projection, sectioning, and working drawings.

5. Describe the function of a standard symbol and illustrate its use.

6. Demonstrate ability to apply principles of projections, spatial graphics, and graphic statistics to selected problems.

7. Develop basic mechanical designs to industry standards.
8. Apply principles of radial and parallel developments.
9. Use intersection points to solve problems.
10. Apply principles and methods of size description.
11. Identify three types of axonemetric drawings: a) isometric, b) dimetric, and 3) trimetric.
12. Illustrate the proper use of dimensions and tolerancing.
13. Given undimensioned drawings, dimension each one using standard practices.
14. Demonstrate proper care and use of drafting instruments.
15. Communicate an idea by making thumbnail, rough, and finished sketches.
16. Using symbols, prepare a working drawing which conforms to accepted drawing standards.
17. Name, compare, and contrast two kinds of working drawings (detailed and assembly) used by industry.
18. Identify employment and career opportunities in this field.
19. Given a situation, draw four types of pictorial drawings to solve the problem: a) oblique, b) isometric, c) one-point perspective, and d) two-point perspective.
20. Describe at least three usages for pictorial illustrations.
21. Give three reasons for using standards to facilitate communications.
22. Describe how to use a sketch as an aid to communication.
23. Illustrate the function of a mock-up by definition and/or construction.
24. Given a situation, choose and justify the need for a model or mock-up.
25. Evaluate communication provided by the mock-up.
26. Describe the computer as a means to make a working drawing.
27. Cut and paste working drawings according to prescribed standards.
28. Solve common construction problems, showing knowledge of basic materials and processes.
29. Recognize four types of engineering graphics and write a brief description.
30. Describe what specifications are and how they aid communication in at least two ways.

31. Demonstrate understanding of the specification concept by reading a one-page supplement and outlining the content.

32. Working in groups of five, write specifications as a supplement to working drawings made previously.

33. Given required information, draw an exploded view of a drawing and render the parts.

Automated Systems (Goals: 1,2,3,5,8,9,10,11)

1. Describe advantages and disadvantages of automated systems.

2. Identify job expectations and the availability of employment in local industries.

Character Generation (Goals: 2,3,7,10)

1. Identify different styles of composition.

2. Use at least two different methods of character generation.

3. Apply a variety of methods and machines for character generation.

4. Operate, adjust, and perform elementary maintenance on character generation equipment.

Methodology (Goals: 2,3,5,10)

1. Demonstrate understanding of design methodology by applying basic principles to the solution of selected problems.

2. Apply the scientific method in the solution of assigned problems.

Presentation and Display Systems (Goals: 2,3,6,10)

1. Select proper medium or media for making a presentation.

2. Prepare visual information for various media.

3. Select appropriate techniques for presenting and displaying information to various audiences.

Reproduction Systems (Goals: 2,3,7,10)

1. Calculate cost for a given process and a given visual communication.

2. List advantages and limitations of major processes.

3. Apply basic selection criteria to selected problems.

Design Conversion (Goals: All)

1. Demonstrate understanding of basic concepts and skills through reproduction of visual communications.
2. Identify employment and career opportunities in field of visual design.
3. Demonstrate safe and desirable work habits.
4. Identify at least four basic methods of printing.
5. List at least four factors that influence choice of a reproduction method.
6. List the common elements of various reproduction systems.
7. Demonstrate competence in photography by properly completing selected assignments.
8. List carriers used in photographic communication.
9. Describe the uses and characteristics of each photographic carrier.
10. Choose or design photographic media materials in terms of convention and personal experience.
11. Produce photographic media materials utilizing various reproduction methods.
12. Demonstrate understanding regulations and ethics involved in the reproduction of visual materials.
13. Select a reproduction system that best meets the requirements of a given job.
14. Compare/contrast the different reproduction systems.
15. Identify occupational competencies required for employment in jobs related to reproduction systems.
16. Position an image in a manner which achieves results according to established criteria.
17. Describe the elements of photographics composition, resulting in effective communication.
18. Describe at least two techniques which can be employed to create effective photographic composition.
19. Contrast and compare the uses of photographic image carriers.
20. Describe the process of developing, recording, and preparation of at least three types of image carriers.

21. Select an idea or message to be communicated by color slides.
22. Compose a series of color slides to tell a story.
23. Write a narration to accompany a slide presentation.
24. Record a slide-narration using a tape recorder.

Image Carrier Assembly (Goals: 1,2,3,7,10)

1. Assemble visual materials, using at least two different reproduction methods.
2. Identify jobs in local industries which require skills and knowledges learned in this course.
3. Prepare, according to production standards, image carriers for major reproduction equipment.

Image Transfer (Goals: 1,2,3,7,10)

1. Operate at least two different pieces of reproduction equipment in a safe and proper manner.
2. Identify skills and knowledges required for employment in jobs requiring equipment operation.
3. Operate at least two different presses in a safe and proper manner.
4. Perform basic equipment maintenance functions.
5. Select appropriate reproduction processes and operate required equipment in a safe and proper manner.

Preserving and Assembling (Goals: 2,3,8,10)

1. List major preservative and assembly techniques used to complete a visual product.
2. Perform basic preservative and assembly techniques according to acceptable trade standards.
3. Apply safe and proper procedures to basic preservative and assembly practices.
4. Apply individual techniques for preserving, finishing, and shipping visual products.

Storage and Retrieval (Goals: 1,2,3,8,10)

1. Identify major methods for abstracting information.
2. List the values and limitations of each abstracting method.
3. Identify specific applications for different storage and retrieval systems.
4. Identify specific occupations and job requirements related to information storage and retrieval.
5. Abstract selected information in a manner appropriate for a given storage and retrieval situation.

Prepare for Form Change (Goals: 2,3,8,10)

1. Prepare materials for form change using an available system.

Recording and Imaging (Goals: 2,3,8,10)

1. Record or image materials to acceptable reproduction levels.
2. Operate equipment in a safe and proper manner.

Index Coding (Goals: 2.3,8,9,10)

1. List the advantages or limitations of each index coding process.
2. List the major applications of index coding.
3. Index and code selected materials in preparation for efficient storage.

Storage and Filing (Goals: 2,3,8,10)

1. Describe the characteristics of current storage and retrieval.systems.

Viewing Systems (Goals: 2,3,8,9,10)

1. List at least three types of viewing systems.
2. List the applications of various viewing systems in local industries.
3. Set up, operate, and evaluate at least two types of viewing systems.

Hard Prints (Goals: 8,9,10)

1. List applications of hard prints in local industrial storage and retrieval systems.

2. Set up a system for storage and retrieval of hard prints using available equipment.

Communication Industry (Goals: All)

1. Describe the uses of the systems approach in industry.
2. Demonstrate understanding of the application of the systems approach to the solution of visual communication problems.
3. Identify employment and career opportunities in a selected communication industry.
4. Describe, in writing, aspects of good employee-employer relations.
5. Describe the organization of a typical visual communication industry.
6. Relate the systems approach to a specific industry and its operation.
7. Create a flowchart showing the variables affecting the systems approach.
8. Devise different approaches to reach a personal goal.
9. Select appropriate methods of communiation for a given problem.
10. Analyze project goals and report in writing whether the project fulfilled these goals.
11. Work as a team member to create a successful end product.
12. Describe the current supply and predicted need for workers in a selected visual communication industry.

ELECTRICITY/ELECTRONICS
Performance Indicators

The student will:

Careers (Goals: 1, 8, 9)

1. Given appropriate resources, describe the economic benefits that result from employment in jobs related to concepts found in the study of basic electricity.
2. Given appropriate resources, list the general educational requirements and special vocational preparation required of people engaged in the fields of electricity, electronics, and instrumentation.
3. Identify need for this information as it relates to major employment areas.
4. Describe occupational opportunities for technical specialists.
5. Describe local (to job) needs and economic status of electrical employment.
6. Relate job opportunities to the concepts being studied in this class.
7. Describe general industrial economics (supply and demand).
8. Develop a written self-assessment of one's own progress in career awareness.
9. Describe actual working conditions under which people engaged in this line of work must perform their duties.
10. List general educational requirements and special vocational preparation required of people engaged in this line of work.
11. Describe the specific interests, aptitudes, temperaments, and physical characteristics required of people employed in this area.
12. Identify specific occupational tasks performed by people working at jobs related to this class.
13. List and describe the economic and fringe benefits that result from employment in jobs related to concepts learned in this class.
14. Identify and describe at least six jobs which are related to or are dependent upon, skills learned in this class.

Safety (Goals: 2, 3, 5. 6, 7)

1. Display a knowledge of safety as applied to the use of electricity in the home, at work, and in school activities.
2. Demonstrate safe procedures involving people, use of tools and equipment, materials and processes, and measuring instruments.
3. Demonstrate consistent use of rules and regulations that comply with safety standards.
4. Demonstrate understanding of hazard analysis procedures.

Atomic Theory (Goals: 4, 8)

1. Write the accepted theory of electricity and how it is able to flow through a wire.
2. Illustrate the structure of an atom.
3. Illustrate the structure of a molecule.
4. Explain basic atomic theory.
5. Identify and describe charges.
6. Illustrate the composition of matter of typical conductors, semi-conductors, and insulators.
7. Write definitions of key terms.
8. Use proper vocabulary when describing electrical theory.
9. Describe the theory of electron flow.
10. Describe how emf is developed in various devices.
11. Identify devices which produce emf.

Energy Conversion/Transmission (Goals: 2, 3, 4, 5, 8)

1. Produce electricity with friction.
2. Generate electricity with heat.
3. List common devices that use thermocouples.
4. Identify characteristics of electro-magnetism as related to electricity.
5. Compare, test, and analyze devices in circuits that do work.
6. Produce electricity with magnetism.

7. Identify devices using chemicals to produce electricity.
8. Produce electricity using chemicals.
9. Compare and analyze a complete and incomplete circuit.
10. Explain the technical operation of circuits.
11. Explain applications of circuits to industry.
12. Describe how mechanical energy is converted into electrical energy.
13. Determine the physical characteristics of permanent and electro-magnets.
14. Identify photoelectric devices.
15. Perform experiments using photoelectric devices.
16. Produce light energy from electrical energy.
17. Identify uses of piezoelectric devices.
18. Perform experiments using piezoelectric devices.

Measurement (Goals: 2, 3, 4, 5, 7, 8)

1. Troubleshoot and repair basic systems.
2. Identify a series circuit.
3. Identify a parallel circuit.
4. Trace the current path in a series circuit.
5. Trace the current path in a parallel circuit.
6. Identify voltage relationships in a series and/or parallel circuit.
7. Connect and read voltages, current, and resistance on a voltohmmeter to an accuracy of 90 per cent.
8. Perform basic measurements with the ammeter and wattmeter.
9. Identify a voltmeter.
10. Place a voltmeter in a circuit correctly.
11. Measure voltage units accurately.
12. Explain how the amount of current in a circuit depends on the resistance of the applied voltage.
13. Explain unique technical applications.

14. Explain importance of such applications to the total industry.

15. Describe the operation of basic and typical circuits.

16. Connect and read voltages and resistance on a vacuum tube voltmeter to an accuracy of 90 per cent.

17. Describe how the current in an AC circuit can vary when DC is applied to that circuit.

18. Apply Ohm's law to practical laboratory problems.

Outputs (Goals: 2, 3, 4, 5, 6, 7, 8)

1. Define and identify a series circuit and mathemetically solve for resistance, voltage drop, and current.

2. Define and identify a parallel circuit and mathematically solve for current, voltage, resistance, and power across each resistor.

3. Solve and/or find the resistance, current, voltage, and power consumed across each resistor in a series-parallel circuit.

4. Describe and mathematically calculate interrelated measurements.

5. Identify and apply measurement techniques used in specialized equipment.

6. Identify skills and knowledges needed for employment in occupations related to class activities.

7. Perform basic maintenance procedures on electrical equipment.

Control (Goals: All)

1. Identify a part name from a given symbol and be able to draw the symbol from memory.

2. Identify resistors of the carbon, power, and variable type.

3. Describe the relationship between current and voltage.

4. Describe the relationship between current and resistance.

5. Identify the factors that classify resistors into types, coding, rating, variable types, and applications.

6. Determine, mathematically, the electrical power consumed by one resistor in a circuit.

7. Identify a capacitor.

8. Determine and list factors which affect capacitance.

9. Determine and list the basic operating characteristics when factors that determine capacitance are varied.

10. Identify an inductor.

11. Identify and list factors which affect inductance.

12. Determine the change in the performance of a circuit by changing the factors which affect inductance.

13. Determine how one meter movement can be used to measure varying values of voltage, current, and resistance.

14. Build and maintain a representative selection from the following:

    a. Control switches.

        (1) Switches.

        (2) Series.

        (3) Parallel.

        (4) Combination.

    b. Devices controlled.

        (1) Lights.

        (2) Motors.

        (3) Electronic systems.

15. Identify and list the characteristics of voltage and current in an AC circuit.

16. Adjust and control an audio generator.

17. Adjust and control an oscilloscope to measure frequency, voltage, and wave shape.

18. Define and describe inductance and list its characteristics.

19. Define voltage, amperage, resistance, capacitance, and wattage and list their characteristics.

Control (Goals: All)

1. Explain and experimentally verify basic operation.

2. Design simple circuits.

3. Explain technical concepts.

4. Discuss basic technical operation.

5. Troubleshoot and maintain simplified installations.
6. Identify and explain all major component parts (blocks).
7. Recognize and describe the basic components of electrical systems as they relate to this course.
8. List the common characteristics of electrical power systems and the laws that apply to them.
9. Describe mechanical and electrical characteristics.
10. Perform typical troubleshooting procedures.
11. Perform typical service procedures.
12. Troubleshoot and maintain typical industrial applications of electrical systems.
13. Perform representative installation and troubleshooting procedures.
14. Maintain operating circuits in a proper manner.
15. Define mathematically and operationally major operating characteristics of electrical systems.
16. Describe unique operating characteristics of selected systems.
17. Describe major manufacturing techniques used by selected electrical systems producers.
18. Apply general concepts in analysis of new equipment and applications.

Design (Goals: 2, 3, 4, 5, 6, 8)

1. Transfer technical problems to operating electrical/electronic solutions.
2. Complete a product design, its construction, installations, and maintenance.
3. Select proper technical solutions to specific types of problems.
4. Explain cost analysis procedures as they apply to the manufacturing portion of product costs.

Service Analysis (Goals: All)

1. Perform basic service analysis processes.
2. Describe the physical construction of a step-up transformer.
3. Describe the physical construction of a step-down transformer.

4. Recognize a diode.
5. Recognize a transistor.
6. Identify a push-button NO (normally open) and NC (normally closed) switch.
7. Identify a SPST switch.
8. Identify a SPDT (Three-way) switch.
9. Identify a DPDT (four-way) switch.
10. Identify a DPST switch.
11. Predict common switch-controlled circuit operation.
12. Connect selected switches in a circuit to operate properly.
13. Perform basic service analysis processes.
14. Test a transformer for shorts, continuity, and turns ratio.
15. Explain a diode's operating characteristics.
16. Connect a diode in a circuit to operate properly.
17. List several uses of a transistor.
18. Compare the operation of a transistor with that of a switch and relay.
19. Connect a transistor in a circuit to operate properly.
20. Recognize a silicon-controlled rectifier and its symbol.
21. Compare the silicon-controlled rectifier to a diode.
22. Compare the silicon-controlled rectifier to a relay.
23. Explain the operation and use of a silicon-controlled rectifier in a circuit.
24. Compare the silicon-controlled rectifier to the transistor.
25. Connect a silicon-controlled rectifier in a circuit to operate properly.

POWER
Performance Indicators

The student will:

Careers (Goals: 1, 13, 14)

1. Identify the different career opportunities available in the power and energy field.

2. Contrast and compare between educational needs for various jobs in the power and energy field.

3. List several jobs of interest in three areas (electricity, mechanics, and fluids).

Historical Background (Goal: 4)

1. Trace the discovery and use of fuels common to man.

2. Name several fuels common to early man.

3. Define terms and display correct use of them.

4. Recognize the uses of simple machines and describe how man has benefited by their uses.

5. Recognize the application of these simple machines in the more complex machines of today.

6. List several types of natural energy sources and explain how they are harnessed or transformed into usable energy.

Sources of Energy (Goals: 1, 5, 13, 14)

1. List three continuous sources of energy that have constantly renewing capabilities.

2. Describe exhaustible sources of energy and list those which have a decreasing supply.

3. List three kinds of fossil fuels and state advantages and disadvantages of each.

4. Compare nuclear fission and fusion, and explain basic atomic chain reaction.

5. Identify specific problems encountered through the use of organic fuels and natural resources used in energy consumption and conversion

Fuels and the Environment (Goals: 6, 13)

1. Identify the constituents of photo-chemical smog and how the pollutants are formed from basic fuels.
2. Identify non-atmospheric pollutants.
3. List several affects of the use of energy resources on the country and its people.

Simple and Complex Machines (Goals: 2, 3, 7, 13, 14)

1. Identify six basic instruments which perform mechanical work.
2. Identify each of the three types of levers.
3. Demonstrate how each is used to gain mechanical advantage.
4. Identify the wheel and axle, pulley, inclined plan, and the wedge.
5. Demonstrate or write how mechanical advantage is gained in each type of simple machine.
6. List several simple machines and their application to the past, present, and future.
7. Identify a first class lever.
8. Demonstrate or describe how mechanical advantage is gained or lost in using the first class lever.

Heat Engines (Goals: 1, 2, 3, 4, 8, 13, 14)

1. Describe the basic principles of operation of the two- or four-stroke reciprocating engine.
2. Identify key parts of the reciprocating internal combustion engine (cylinder black and head, combustion chamber, cylinder, pistons and piston rings, connecting rod, camshaft, carburetor).
3. Describe at least two of the three engine accessory systems and identify at least three major parts of these systems.
4. Describe the difference between volumetric and brake thermal efficiency.
5. Describe the chemistry of combustion and its application.
6. Explain molecular action as combustion takes place.
7. Compute compression ratio given necessary specification.

8. Write an essay outlining the development of the two- and four-cycle engine.

9. Describe the principles of fuel ignition in diesel engines.

10. Discuss the principles of fuel ignition in turbine engines.

11. Describe the principles of fuel ignition in gasoline engines and list the differences between diesel and turbine engines.

Operating Principles (Goals: 1, 2, 3, 9, 13, 14)

1. Explain the concept of the rotary combustion engine using a transparent model of the engine as a guide.

2. Identify pictures of the rotor, the housing, the intake and exhaust port, and the end covers of the rotary combustion engine.

3. Write or recite Newton's Third Law of Motion, which states that for every action there is an equal and opposite reaction.

4. Write or recite the basic operating principles of the reaction air stream engine.

5. Recognize the operational differences between the turbojet engine, the turboprop engine, and the turbofan engine.

6. Write or recite the basic principles of operation of the gas turbine engine.

7. Identify the basic parts of the gas turbine engine: the compressor, the combustion chamber, the compressor turbine, the power turbine, the regenerator.

8. Write or recite the differences between a reaction air stream engine and a rocket engine.

9. Write or recite the two basic classes of rockets.

10. Describe the operation of the carburetor on a four-cycle engine.

11. Describe the operation of a diesel fuel injection system.

12. List the chemical components found in the environment which are a result of combustion in internal combustion engines.

13. Describe how pollutants affect a large city.

14. Describe the basic operating principles of the steam turbine.

15. List two or more applications of the steam turbine.

Mechanical Power Transfer (Goals: 1, 2, 3, 10, 13, 14)

1. Demonstrate the ability to increase speed and decrease power or decrease speed and increase power by changing the sizes of the fears on the input or output shaft by either writing it on paper or actually making the changes on a demonstration unit.
2. List two advantages and two disadvantages of the chain drive.
3. List two advantages and two disadvantages of the belt drive.
4. List four applications of both the belt and the chain drive.
5. Identify three basic types of gears from the following list: spur, helical, worm, bevel.
6. Identify and describe the system used to direct power at right angles from the source.
7. Determine ratios between gears by mathematical calculation and physical experimentation.
8. Describe how a cam is able to transmit rotary motion to linear motion.

Clutches (Goals: 1, 2, 3, 11, 13, 14)

1. List four methods of engaging or disengaging a clutch.
2. Perform basic disassembly and assembly operations on a clutch.
3. Write or recite the purpose of the clutch.
4. Recognize at least three types of clutches.
5. Explain the operating principles of at least one type of clutch.

Fluid Power Systems (Goals: 1, 2, 3, 4, 12, 13, 14)

1. Compare the difference between a liquid and a gas.
2. Relate why a study of fluid power is necessary.
3. Compare and contrast fluid movement with electrical and mechanical movement.
4. Identify uses of fluid power.
5. Recognize the basic components of the hydraulic system.
6. State the characteristics of fluids and the laws that apply to them.

7. List examples of simple hydraulic applications.
8. Define pneumatics.
9. Recognize uses for pneumatics.
10. Identify laws controlling pneumatic use.
11. Describe the basic cycle of a refrigeration unit.
12. List applications of refrigeration units.
13. State how hydraulic and pneumatic systems are alike.
14. List any differences in the two systems.
15. Define vacuum.
16. Recognize where vacuum is used.
17. Explain how the movement of air to fill a vacuum does work for us.
18. List the individual parts of the hydraulic system (input).
19. Explain how these parts work together.
20. Compare the hydraulic (input) sources to mechanical and electircal (input) sources.
21. List the individual parts of the pneumatic (input) components.
22. Explain how these parts work together.
23. Differentiate between pneumatic sources and hydraulic sources.
24. Identify the most common types of direction flow valves.
25. Explain orally which two-way valve would be more suitable for a certain application and why.
26. List the parts of a two-way valve.
27. List all the components that are protected by relief valves in a fluid system.
28. Adjust relief valves to a given pressure.
29. Explain the downstream side of a pressure reducing valve and state where this type valve is used.
30. Differentiate between a back-pressure check which opens at a given pressure and those that open as soon as flow begins.

31. Compare check valves with valves that have an adjustable orifice.

32. Identify the various checking mechanisms.

33. Construct an open-end manometer and use it to measure pressure.

34. Contrast a bourdon tube pressure gauge with a manometer and list data.

35. Solve problems using the hydrometer and manometer to secure data.

36. Identify which type meter would be best to use for measuring the flow in a particular system.

37. Identify the variety of materials used depending upon the pressure contained within the fluid power system.

38. Correctly identify when to use pipe sealer or a synthetic O-ring for sealing a system.

39. Identify the different types of connections and fittings used in fluid power systems so that proper repair and maintenance could be completed.

40. List the different types of cylinders.

41. Differentiate between types of cylinders.

42. Solve problems of thrust.

43. Define motor.

44. Name the different types of motors and their specialized uses.

45. Define actuator, reciprocating motion, and rotary motion.

46. Compare the operation of a fluid coupling and a torque convertor.

47. Describe the basic principle of a water turbine.

48. Name the basic parts of a power steering system.

49. Explain how the power steering functions.

50. Tell how the fluid or air is used to cause movement to slow or stop a vehicle.

51. Define the meaning of fluid power as it relates to this course.

52. Recognize the basic components of fluid power systems.

53. State the common characteristics of fluid power systems and the laws that apply to them.

54. Name and recognize the various control devices used in industry or which are encountered in doing your own thing.

55. Trace the historical development of control devices used to control machinery found in combined systems.

56. List the major historical developments that led to the present day use of combined systems in industry.

57. Define feedback and relate how it affected the development of automation.

58. Compute the cost of materials of a given product.

59. Compute the time to manufacture this given product by using hand methods only and by machine methods.

60. Estimate the cost of machines to manufacture each of the parts of the given product.

61. Calculate the cost break-even point of manufacturing by hand method and by machine method.

62. Demonstrate how the studied system operates.

63. Show how each control device will operate in the studied system.

64. Assemble from laboratory equipment a small model of a lift or elevator operated by a fluid system.

65. Measure breakaway pressure, moving pressure, input distance moved and output distance moved, and calculate the mechanical advantage of distance for the system.

66. Identify and write the symbol for the devices used in combined systems.

67. List the types of systems studied thus far in the course and relate some common uses of each.

68. Evaluate the various systems using only the information given thus far in the course.

69. Assemble from laboratory equipment a fluid-mechanical assembly that will automatically control the motion in a system.

70. Record the effect of varying the air pressure and the gear ratio used to operate this system.

71. Assemble from laboratory equipment a fluid-mechanical assembly that will produce continuous and rapid reciprocating motion.

72. Observe and record the effect on the system of changing the operating pressure.

73. Identify the types of automatic system and name which of the three power systems are involved in various simple and complex automatic systems.

74. Combine a variable speed air cylinder with an existing fluid-mechanical system and observe the phasal relationship between motor and cylinder.

75. Contrast the way man accomplished various things in his life, such as transportation, food processing, and manufacturing, in the early 1900's 1930's, present, and future possibilities.

76. Relate the advantages and disadvantages of automatic systems that are used in industry.

77. Contrast the pros and cons of the effect of automation on our industrial society.

78. Describe five of the manufacturing techniques involved in the industrial use of automatic systems.

79. Relate the type of interrelationship between electrical-fluid-mechanical power systems involved in these manufacturing techniques.

80. Identify mechanical, fluid, and electrical systems used in combination to perform specific functions common to everyday life.

81. Compare the three power systems in terms of why they have been selected to perform specific functions common to everyday life.

82. Identify manual, semi-automatic, and automatic devices involving combinations of mechanical, fluid, and electrical systems.

83. State advantages and disadvantages of automation.

PHILOMATH SCHOOL DISTRICT 17J

ALIVE Program

(Allied Learning in Vocational Exploration)

Student Managed Learning in Art, Home Economics, and Industrial Arts*

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PHILOMATH SCHOOL DISTRICT 17J

ALIVE Program

Enclosed in this packet are the tentative program goals, competencies, and performance indicators for the industrial arts segment of the Philomath Middle School's ALIVE Program. The ALIVE Program (Allied Learning in Vocational Exploration) is a student-managed/individualized learning program involving art, home economics, and industrial arts in a team instruction approach.

The technical areas described herein indicate present and long-range plans for implementation. Each of the technical areas, with the exception of wood/forest products, is currently being implemented into the program. The program will be expanded in view of student needs and available instructional staff and facilities.

PHILOMATH SCHOOL DISTRICT 17J

ALIVE Program
Careers
(1.0)

(For Discussion Only)

Program Goal

1.1. Students will demonstrate habits necessary to explore effectively in various career areas.

- 1.1.1. Perform work in a manner safe to themselves and others.
    - 1.1.1.1. Given simulated work situations, the student will be able to list safety rules for tools or equipment used.
    - 1.1.1.2. Given specific work assignments, the student will demonstrate safe practices.
- 1.1.2. Demonstrate responsibility for punctuality and regular attendance at work.
    - 1.1.2.1. Given descriptions of various businesses, the student can predict the effect of tardiness or poor attendance on the operations.
    - 1.1.2.2. The student will be able to maintain a record of punctuality and regular attendance at school.

1.2. Students will recognize the importance of positive attitudes toward work.

- 1.2.1. Understand the importance of attitudes that people have toward work.
    - 1.2.1.1. Given an assignment, the student will be able to explain the relationship of personal attitudes to achievement.
    - 1.2.1.2. Ask a teacher or employer to rate you on the quality and quantity of work you produce. Report the rating in writing.
    - 1.2.1.3. Describe, in writing, how you feel you should treat others and their personal property.
    - 1.2.1.4. Describe, in writing, how you feel about: a) getting to school or work on time, b) taking coke breaks, c) leaving school or work early, and d) not showing up for school or work.

1.2.1.5. Ask a teacher or employer to rate your attitude and cooperation toward school or work assignments. Report this rating in writing.

1.2.1.6. Ask your classmates or fellow-workers to tell you what kind of a team member you are when working on a group project. Report the results in writing.

1.2.1.7. Describe, in writing, what you feel you owe an employer, teacher, other students, or fellow workers.

1.3. Students will be able to maintain acceptable interpersonal working relationships.

1.3.1. Demonstrate the behaviors that signal willingness to cooperate with others on work assignments.

1.3.1.1. In a simulated or real committee meeting, the student will share ideas and accept responsibility for completing a group project.

1.3.2. Demonstrate correct job application procedures.

1.3.2.1. Given a variety of sample applications, the student will be able to complete them, giving appropriate information.

1.3.2.2. Write a letter of application for a job which interests you.

1.3.2.3. Write a personal resume.

1.3.2.4. Engage in a simulated job interview with another student.

1.3.2.5. Secure and fill out a social security application form.

1.3.2.6. Secure and fill out an employee's withholding exemption form.

1.4. Students will be able to make appropirate career decisions.

1.4.1. Explore career fields most closely related to personal interests and abilities.

1.4.1.1. Given proper guidance, the student will be able to match personal skills and experience with several occupations in chosen career fields.

1.4.1.2. Describe your life goals. Describe the kind of job you would like to have, family life, hobbies, and other things.

1.4.1.3. Describe the kinds of things you like to do. Do you like to work with data, people, or things?

1.4.1.4. Describe those things you do real well.

1.4.1.5. Describe how well you adapt to frequent changes, repetitive or cycle operations, close supervision, being responsible for the activities of others, working alone, working under stress, and working under precise, set limits and tolerances.

1.4.1.6. Describe courses you have had which have helped you learn about jobs and work.

1.4.1.7. Describe both part- and full-time work experiences you have had and tell how they have helped you learn about jobs and work.

1.4.1.8. List the jobs held by members of your family and describe what they do in these jobs.

1.4.1.9. Write out a tentative career plan which describes your plans for the future, how you propose to get there, and available resources.

1.4.1.10. Write out a personal data sheet which includes information on personal items, education, work experience, hobbies, and club activities.

1.4.1.11. Select a job and describe the length of time it takes to learn how to perform the work.

1.4.1.12. Select a job which requires a period of apprenticeship and describe these requirements.

1.4.1.13. Write a description of the special career preparation required in order to get a job of your choice.

1.4.1.14. Write a description of the general educational background required of a person who is employed in a selected job.

1.4.1.15. List the names and addresses of several trade or technical schools which offer courses leading to jobs which are of interest to you.

1.4.1.16. List the names and addresses of several branches of the armed services offering courses leading to jobs which interest you.

1.4.1.17. List the names and addresses of several community colleges which offer courses preparing people for employment in jobs which interest you.

1.4.1.18. List the names and addresses of several colleges or universities offering courses leading to jobs which interest you.

1.4.1.19. List courses in your school district which will help you prepare for a job which interests you.

1.4.1.20. Select a job and describe the costs involved in getting the training required for employment.

1.4.1.21. Select a job and describe the entrance requirements to a training program that will develop job entry level skills.

ELECTRICITY/ELECTRONICS
(2.0)

(For Discussion Only)

Program Goal

2.1. The student will be able to read, interpret, and apply electrical schematics to practical situations.

- 2.1.1. Demonstrate the ability to recognize and apply basic electrical symbols to lab problems.
  - 2.1.1.1. Given basic electrical symbols, describe and/or identify component counterparts.
- 2.1.2. Demonstrate the ability to read, interpret, and develop basic electrical plans and schematics.
  - 2.1.2.1. Given a basic electrical plan or schematic, read, interpret, and apply the information to a lab problem.
  - 2.1.2.2. Given a simple electrical circuit, draw a plan or schematic which correctly illustrates the circuit.

2.2. The student will be able to identify, select, and use proper electrical hand tools and materials in a practical situation.

- 2.2.1. Demonstrate proper use of electrical hand tools in selected laboratory situations.
  - 2.2.1.1. Given instructions and appropriate tools, perform wire cutting and stripping operations as directed.
  - 2.2.1.2. Given a problem, perform soldering operations as directed.
  - 2.2.1.3. Given a lab exercise, identify, select, and use screwdrivers and related hand tools as directed.
  - 2.2.1.4. Given a lab exercise, identify, select, and use common housewiring tools.
- 2.2.2. Demonstrate an understanding of, and ability to use, selected electrical supplies and materials in a specified manner.
  - 2.2.2.1. Given a lab problem and various kinds of solder, select and apply the most appropriate one to the exercise.
  - 2.2.2.2. Given a wire gauge and various sizes of wire, determine the proper wire size for a given lab exercise.

- 2.2.2.3. Given various components and a schematic, select the specified components.

2.3. The student will be able to properly connect basic electrical components in a circuit.

- 2.3.1. Demonstrate the ability to properly connect components in a series circuit.
    - 2.3.1.1. Given a plan or schematic, connect a series circuit according to specifications.
    - 2.3.1.2. Given a plan or schematic, solder components in a series circuit according to specifications.
    - 2.3.1.3. Given a series circuit, trace on paper, current path through it.
    - 2.3.1.4. Describe the voltage relationships in a given series circuit.
- 2.3.2. Demonstrate the ability to properly connect electrical components in a parallel circuit.
    - 2.3.2.1. Given a plan or schematic, connect a parallel circuit according to plan.
    - 2.3.2.2. Given a plan or schematic of a parallel circuit, solder components in place as directed.
    - 2.3.2.3. Given a parallel circuit, trace on paper current path in it.
    - 2.3.2.4. Describe the voltage relationships in a given parallel circuit.
- 2.3.3. Demonstrate the ability to properly connect a compound electrical circuit.
    - 2.3.3.1. Given a plan or schematic of a compound circuit, select and connect components so that the circuit functions properly.

2.4. The student will be able to make electrical measurements and calculations through application of basic test instruments and formulas.

- 2.4.1. Demonstrate an understanding of, and the ability to take, measurements with basic electrical test instruments.
    - 2.4.1.1. Given a test circuit and VOM, make voltage, resistance, and current readings.
    - 2.4.1.2. Given a test light, check a circuit for continuity.

        - 2.4.1.3. Given several test instruments, identify an ohmmeter, place it in a circuit correctly, and measure resistance units accurately.
        - 2.4.1.4. Identify a voltmeter, place it in a circuit correctly, and measure voltage accurately.
        - 2.4.1.5. Identify an ammeter, place it in a circuit correctly, and measure current flow accurately.
        - 2.4.1.6. Identify a wattmeter, place it in a circuit correctly, and interpret power correctly.
    - 2.4.2. Demonstrate the ability to make basic electrical calculations.
        - 2.4.2.1. Given voltage and resistance, solve for current.
        - 2.4.2.2. Given resistance and current, solve for voltage.
        - 2.4.2.3. Given current and voltage, solve for resistance.
        - 2.4.2.4. Given current and voltage, solve for power.
        - 2.4.2.5. Given appliance loads and house plan, calculate circuit capacities and number of branch circuits, etc. (service needs).

MECHANICS
(3.0)

(For Discussion Only)

Program Goal

3.1. The student will be able to demonstrate proper use of the tools and machinery used by industrial mechanics.

3.1.1. Demonstrate proper use of hand tools common to industrial mechanics.

3.1.1.1. Given a variety of mechanic wrenches, identify and demonstrate their proper use.

3.1.1.2. Given a variety of screwdrivers, nutdrivers, and related tools, identify and demonstrate their proper use.

3.1.1.3. Given a variety of mechanic pliers, identify and demonstrate their proper use.

3.1.1.4. Given a variety of mechanic cutting tools, identify and demonstrate their proper use.

3.1.1.5. Given a variety of mechanic measuring instruments, demonstrate their proper use.

3.1.2. Demonstrate proper use of power tools common to industrial mechanics.

3.1.2.1. Given a hand drill or drill press, drill a hole to specification.

3.1.2.2. Given materials, arc weld steel plate.

3.2. The student will demonstrate an understanding of, and ability to work with, basic industrial systems.

3.2.1. Demonstrate an understanding of or ability to perform basic service operations on common power sources.

3.2.1.1. Given a two stroke engine, perform basic service operations as directed.

3.2.1.2. Given a four-stroke engine, perform basic service operations as directed.

3.2.1.3. Given information on a rotary engine, explain its operation and identify pictures of the roter, housing, intake and exhaust port, and end covers.

3.2.1.4. Write the basic operating principles of the air stream engine.

3.2.1.5. Write the basic principles of gas turbine operation and identify the compressor, the combustion chamber, compressor turbine, power turbine, and regenerator.

3.2.1.6. Describe the two basic classes of rockets.

3.2.1.7. Write the basic operating principles of the steam turbine.

3.2.2. Demonstrate understanding of, and ability to apply, principles of mechanical energy transmission.

3.2.2.1. Given various-sized pulleys or chain sprockets, increase speed and decrease torque (or decrease speed and increase torque) by changing these variables.

3.2.2.2. Given various-sized gears, increase speed and decrease power (or decrease speed and increase power) by changing gears.

3.2.2.3. Given a basic mechanical system, recognize and describe the basic parts.

3.2.2.4. Given basic components, connect them into a mechanical system so it functions properly.

3.2.3. Demonstrate an understanding of, and ability to apply, the basic principles of fluid power systems to practical situations.

3.2.3.1. Recognize and describe basic components of a hydraulic system.

3.2.3.2. Given basic components, connect them into a hydraulic system so it functions properly.

3.2.3.3. Given laboratory components, assemble a model of a lift elevator operated by a fluid system.

3.2.4. Demonstrate an understanding of, and ability to apply basic principles of compound electrical, fluid, and mechanical systems to practical situations.

3.2.4.1. Given simple electrical, fluid, and mechanical systems, identify and describe key components.

3.2.4.2. Given laboratory components, construct a fluid-mechanical assembly that will automatically control motion in a system.

3.2.4.3. Given appropriate components, construct a fluid-mechanical assembly that will produce continuous and rapid reciprocating motion.

3.2.4.4. Given required components, construct an electric motor driven system that can be shifted in and out of operation by use of fluid controls.

GRAPHIC COMMUNICATIONS
(4.0)

(For Discussion Only)

Program Goal

4.1. The student will be able to demonstrate the ability to design and present visual communications.

- 4.1.1. Demonstrate the ability to visualize an idea.
  - 4.1.1.1. Given a problem, select and apply graphic symbols to convey the message.
  - 4.1.1.2. Given a problem, communicate the idea by making thumbnail, rough, and finished sketches.
- 4.1.2. Demonstrate the ability to present an idea in completed form.
  - 4.1.2.1. Given basic graphics tools, instruments, and equipment, demonstrate their proper use.
  - 4.1.2.2. Given a problem, demonstrate proper use of dimensions and tolerancing.
  - 4.1.2.3. Given a problem, apply the principles of orthographic projection and pictorial drawing in conveying the message.
- 4.1.3. The student will be able to read, interpret, and develop basic plans, drawings, and blueprints.
  - 4.1.3.1. Transform an idea into a visual image through freehand sketching.
  - 4.1.3.2. Given a problem, prepare a three-view drawing complete with dimensions and notations.
  - 4.1.3.3. Given a set of blueprints, interpret the information and apply it in a proper manner.

4.2. The student will demonstrate the ability to prepare materials for reproduction.

- 4.2.1. Demonstrate the ability to identify different types of composition and apply them in completion of selected problems.
  - 4.2.1.1. Given a problem, set type to convey a message or idea.
  - 4.2.1.2. Develop an idea or message on a paper offset master.
  - 4.2.1.3. Given a mimeograph master, place a message on it so as to effectively communicate the meaning.

        - 4.2.1.4. Apply visual symbols to a spirit master in a manner which will effectively communicate an idea or message.
        - 4.2.1.5. Develop an idea or message, using line art.

4.3. The student will demonstrate understanding of, and the ability to perform, basic graphic reproduction procedures.

- 4.3.1. Demonstrate the ability to apply various techniques to reproduce selected visual messages.
    - 4.3.1.1. Given appropriate equipment, reproduce a message via the letterpress method.
    - 4.3.1.2. Given a spirit duplicator, reproduce a ditto master in sufficient quantity and quality to effectively convey an idea or message.
    - 4.3.1.3. Given appropriate equipment, reproduce a message via block press.
    - 4.3.1.4. Given appropriate equipment, reproduce a message via silk screen.
    - 4.3.1.5. Given appropriate equipment, develop a rubber stamp.

CONSTRUCTION/WOODWORKING
(5.0)

(For Discussion Only)

Program Goal

5.1. The student will be able to apply basic planning techniques to wood/construction procedures.

5.1.1. Demonstrate ability to interpret plans.

5.1.1.1. Given a project plan, prepare a bill of materials for the project and estimate its cost.

5.1.1.2. Given a project plan, secure materials as directed.

5.1.1.3. Given a plan and materials, layout and measure stock as directed.

5.2. The student will be able to operate both hand and power construction/woodworking tools.

5.2.1. Perform basic wood/construction operations using appropriate hand tools.

5.2.1.1. Given a problem, select and use basic hand tools to cut stock to appropriate size.

5.2.1.2. Given a plan, select and use basic hand tools to shape and plan stock to specifications.

5.2.1.3. Given a project plan, use basic hand tools to drill and bore holes to specifications.

5.2.1.4. Using basic hand tools, assemble a project to specifications, using appropriate fasteners and adhesives.

5.2.1.5. Using basic hand tools, prepare surfaces for application of wood finishes and preservatives.

5.2.2. Demonstrate the ability to perform basic machine construction/woodworking procedures.

5.2.2.1. Given a project plan, cut materials to specified size, using power tools.

5.2.2.2. Given a plan, shape and plane stock to specifications, using power tools.

5.2.2.3. Using power tools, drill and bore holes in stock according to specifications.

5.2.2.4. Using power tools, prepare wood surfaces for application of wood finishes and preservatives.

5.3. The student will be able to apply basic wood/construction techniques to selected problems.

5.3.1. Demonstrate understanding of and the ability to perform selected trowel trade procedures.

5.3.1.1. Given a lab problem, set up batter boards and establish building lines.

5.3.1.2. Given instructions, mix concrete with proper proportions for a particular task.

5.3.1.3. Given a plan. mix mortar with proper proportions for a particular task.

5.3.1.4. Given a plan, mix plaster as directed and apply to a particular task.

5.3.2. Demonstrate understanding of and the ability to perform selected carpentry tasks.

5.3.2.1. Given a set of plans, layout and frame a wall to specification.

5.3.2.2. Given a set of plans, layout and cut rafters to specification.

5.3.2.3. Given a set of plans, apply appropriate siding, roofing, and flashing materials, as specified.

5.3.2.4. Given plans, construct a half-scale corner construction as specified.

5.3.2.5. Given plans, construct a full-scale corner construction as specified.

5.3.2.6. Given a set of plans, construct a structure as specified.

5.3.2.7. Given instructions, assemble a project using various fasteners and adhesives as specified.

5.3.3. Demonstrate understanding of, and the ability to perform selected plumbing-pipefitting tasks.

5.3.3.1. Given a set of plans, layout, mark, and cut openings to accommodate pipe and fittings.

5.3.3.2. Given instructions, layout, mark, cut, break, band, and fasten pipe and fittings as directed.

5.3.3.3. Given instructions, assemble and install valves, fixutres, and trim.

5.3.4. Demonstrate understanding of, and the ability to perform, basic finishing techniques.

5.3.4.1. Given instructions, prepare surfaces to receive finishes or coverings.

5.3.4.2. Given a lab problem, select, mix, and apply appropriate adhesives, paints, preservatives, and related coverings.

METALWORKING
(6.0)

(For Discussion Only)

Program Goal

6.1. The student will be able to demonstrate an understanding of, and the ability to perform, hot metal processes and procedures.

    6.1.1. Demonstrate an understanding of basic metallurgy principles and apply them to practical situations.

        6.1.1.1. Identify properties of various metals.

        6.1.1.2. Test and compare properties of given metals.

        6.1.1.3. Identify, contrast, and compare ferrous and nonferrous.

    6.1.2. Demonstrate the ability to perform selected welding operations on given projects.

        6.1.2.1. Demonstrate safe practices and procedures when performing welding operations.

        6.1.2.2. Given spot welding equipment, join two pieces of equipment.

        6.1.2.3. Weld a butt, lap, corner, T, and edge joint using oxyacetylene process.

    6.1.3. Demonstrate the ability to perform selected cutting and brazing operations.

        6.1.3.1. Cut metals to specification using an oxyacetylene cutting torch.

        6.1.3.2. Given nonferrous filler, join metal via the oxyacetylene brazing process.

        6.1.3.3. Fasten two metals together using the soldering process.

    6.1.4. Demonstrate the ability to perform heat treating operations on selected jobs.

        6.1.4.1. Harden a given metal.

        6.1.4.2. Temper a selected metal.

        6.1.4.3. Anneal a selected metal.

    6.1.5. Demonstrate the ability to perform foundry operations.

        6.1.5.1. Given appropriate tools and material, prepare a ready-to-pour mold.

        6.1.5.2. Cast a metal object by pouring molten metal into a prepared mold.

6.2. The student will be able to demonstrate an understanding of the ability to perform basic machining operations.

6.2.1. Demonstrate the ability to remove metal according to specification.

6.2.1.1. Finish and polish a metal object to specification using an abrasive grinder.

6.2.2. Demonstrate the ability to perform basic boring and drilling operations to specifications.

6.2.2.1. Perform basic drilling, counterboring, countersinking, topping, and reaming operations on the drill press.

6.2.3. Demonstrate the ability to perform basic metal cutting operations with both hand and power saws.

6.2.3.1. Given a hand hack saw, cut metal stock to specified length.

6.2.3.2. Given a power hack saw, cut metal stock to specified length.

6.3. The student will be able to perform basic metal fabrication operations to specification.

6.3.1. Demonstrate the ability to perform basic sheet metal operations in an acceptable manner.

6.3.1.1. Given specifications, transfer a pattern from a template to sheet metal.

6.3.1.2. Given hand snips and shears, cut sheet metal to size.

6.3.1.3. Punch or drill a hole in a seam in preparation for riveting.

6.3.1.4. Given hand-set and pop rivets, secure a seam.

6.3.1.5. Given a problem, fold metal seam according to specifications.

6.3.1.6. Given a job, shape a sheet metal cylinder on a slip roll.

6.3.1.7. Given a problem, perform appropriate edge operations using the rotary machine.

6.3.2. Demonstrate the ability to perform basic wrought metal operations.

6.3.2.1. Given a problem, bend metal to an irregular radii on a bending machine.

6.3.2.2. Fasten wrought metal according to specification.

WOOD/FOREST PRODUCTS
(7.0)

(For Discussion Only)

Program Goal

7.1. Students will be able to demonstrate understanding of forest processing systems.

- 7.1.1. Demonstrate understanding of forest insects and diseases.
  - 7.1.1.1. List at least five major diseases.
  - 7.1.1.2. List and discuss at least five major forest insects.
- 7.1.2. Demonstrate understanding of measurements and measuring equipment.
  - 7.1.2.1. Identify ten major measuring tools.
  - 7.1.2.2. Measure standing tree diameter and height.
  - 7.1.2.3. Measure tree age.
  - 7.1.2.4. Compute board feet.
  - 7.1.2.5. Survey a plot of land.
- 7.1.3. Demonstrate understanding of a timber harvest.
  - 7.1.3.1. Plan an overall timber harvest.
  - 7.1.3.2. Describe tree removal methods.
  - 7.1.3.3. Describe yarding and skidding systems.
  - 7.1.3.4. Describe techniques for loading and hauling logs.
  - 7.1.3.5. Describe fire regulations.
- 7.1.4. Demonstrate understanding of mill techniques.
  - 7.1.4.1. List major supply sources for mills.
  - 7.1.4.2. Describe raw storage techniques.
  - 7.1.4.3. List debarking methods and log break-down techniques.
  - 7.1.4.4. Perform ripping and crosscutting operations.
  - 7.1.4.5. Describe techniques for drying.
  - 7.1.4.6. Describe techniques for surfacing.
  - 7.1.4.7. List techniques for grading.
  - 7.1.4.8. List characteristics of plywood.
  - 7.1.4.9. List types of veneer manufacturing.

        - 7.1.4.10. Describe gluing techniques.
        - 7.1.4.11. List techniques for finishing.
        - 7.1.4.12. List uses of plywood, fiberboard, and particle board.
        - 7.1.4.13. Describe techniques of board pressing.
        - 7.1.4.14. List types of wood fibers.
        - 7.1.4.15. Describe types of pulp and paper.
        - 7.1.4.16. List criteria for quality control.
- 7.2. Students will be able to demonstrate understanding of wood and wood products technology.
    - 7.2.1. Demonstrate understanding of wood products.
        - 7.2.1.1. Describe wood products.
        - 7.2.1.2. List at least five uses of wood and wood byproducts.
    - 7.2.2. Demonstrate an understanding of trees.
        - 7.2.2.1. Identify the basic parts of given trees.
        - 7.2.2.2. Describe deciduous and coniferous trees.
        - 7.2.2.3. Given a variety of tree types, categorize them.
        - 7.2.2.4. Describe growth characteristics of given trees.
        - 7.2.2.5. Given selected woods, list their characteristics.
    - 7.2.3. Demonstrate an understanding of, and ability to apply, glues.
        - 7.2.3.1. Describe natural and synthetic glues and their application.
        - 7.2.3.2. Given a problem, select and apply the proper glue in the appropriate manner.
    - 7.2.4. Demonstrate understanding of pollution resulting from the forest product industry.
        - 7.2.4.1. List, describe, and categorize major industrial pollutants.
        - 7.2.4.2. Given a problem, test for pollution.
        - 7.2.4.3. List and describe the major provisions of selected pollution laws.
        - 7.2.4.4. List and describe current pollution controls.

7.3. Students will be able to demonstrate understanding of process control.

- 7.3.1. Demonstrate understanding of basic mathematics as applied to the forest products industry.
    - 7.3.1.1. Apply decimals, percentage equivalents, and fractions to selected problems.
    - 7.3.1.2. Apply both English and metric units of length and mass to selected problems.
    - 7.3.1.3. Convert English and metric units.
    - 7.3.1.4. Given selected problems, solve using diameter scales, volume tables, logers tape, and carpenters rule.
- 7.3.2. Demonstrate understanding of natural and mechanical defects in logs.
    - 7.3.2.1. Given defective log samples, identify the cause as: rot, crook, sweep, snake, pitch ring, and wormhole.
    - 7.3.2.2. Given defective log samples, identify the cause as: stump pull, breaks, yarding, and loading.
- 7.3.3. Demonstrate understanding of lumber grades, sizes, and testing.
    - 7.3.3.1. Given selected problems, classify lumber by the following methods: yard, factory-shop, and structural.
    - 7.3.3.2. Given lumber samples, grade them according to standards.
    - 7.3.3.3. Given samples of plywood, veneer, and particle board, grade each according to acceptable standards.

7.4. Students will demonstrate understanding of the operation and maintenance of forest product industry equipment.

- 7.4.1. Demonstrate understanding of, and the ability to operate and maintain, basic processing machines.
    - 7.4.1.1. Given appropriate orientation, operate sanding machines, saws, routers, shapers, and drills.
    - 7.4.1.2. Perform basic sharpening, lubricating, adjusting, and maintenance procedures on selected equipment.
- 7.4.2. Demonstrate understanding of mobile equipment.
    - 7.4.2.1. Identify and describe the use of tractors, yarders, trucks, fire equipment, and forklifts.

7.4.2.2. Describe the various methods of lubrication, maintenance, and storage applied to selected mobile equipment.

7.4.3. Demonstrate understanding of motors and engines.

7.4.3.1. Describe the operation of an engine and motor.

7.4.3.2. Describe starting, running, and stopping procedures for selected engines and motors.

7.4.3.3. Describe basic adjustments, maintenance procedures, and storage practices for selected motors and engines.

PLASTICS
(8.0)

(For Discussion Only)

Program Goal

8.1. The student will demonstrate understanding of and the ability to use plastics materials and processes.

8.1.1. Demonstrate understanding of plastics materials.

8.1.1.1. Given five examples, differentiate between thermoset and thermoplastic materials.

8.1.1.2. Given a problem, select the appropriate plastic material to solve the problem.

8.1.2. Demonstrate understanding of, and the ability to perform, basic plastic working processes.

8.1.2.1. Given a problem, perform plastic molding operations by plasticizing pellets under heat and pressure in a closed mold.

8.1.2.2. Given liquid or powdered thermoplastic material, solve a problem by placing the material in an enclosed mold which rotates on two axes in a heated chamber.

8.1.2.3. Given a problem and compression molding equipment, apply heat and pressure to thermoset molding compound in a closed mold.

8.1.2.4. Given a card or similar item, place it between two sheets of thermoplastic vinyl or acetate and apply heat and low pressure until the plastic fuses.

8.1.2.5. Given instructions and phenolic impregnated kraft paper, melamine impregnated decorative sheet, and a melamine impregnated overlay sheet, apply heat and high pressure to form a laminate.

8.1.2.5. Given a problem and fiberglas materials, saturate glass cloth and mat with thermoset polyester resin, place in a mold, and allow to cure.

8.1.2.6. Given a problem and appropriate equipment, dip a preheated metal mandrel into a liquid plastisol and return to the oven; when cooled, strip plastic from the mandrel.

8.1.2.7. Given instruction and equipment, perform cold dipping operations by placing a cold metal object into a heated cellulose acetate butyrate and then removing to cool.

8.1.2.8. Perform fluidized bed coating operations by placing a preheated metal object in an oven where air is forced through powdered vinyl or polyethylene.

8.1.2.9. Given a problem and vacuum equipment, draw heated sheet plastic over a mold as a pump creates a vacuum under the plastic.

8.1.2.10. Given the ingredients of polyurethane foam, mix and pour them as directed into a closed mold and allow to cure.

8.1.2.11. Given a plan sheet and beads filled with penthane gas, insert them in boiling water and then place in an enclosed mold.

8.1.2.12. Given an instruction sheet, encase a coin, stamps, insect, or suitable object between two layers of polyester resist as directed.

8.1.2.13. Given a bar sealer and thermoplastic film, fuse the two using heat and pressure.

8.1.2.14. Given a suitable object, heat gun, and instructions, shrink vinyl around the object as directed.

8.1.3. Demonstrate the ability to identify, select, and apply available plastics materials and processes to selected laboratory experiences.

8.1.3.1. Given access to various plastics processes, identify, select, and apply one or more to the solution of a selected problem.